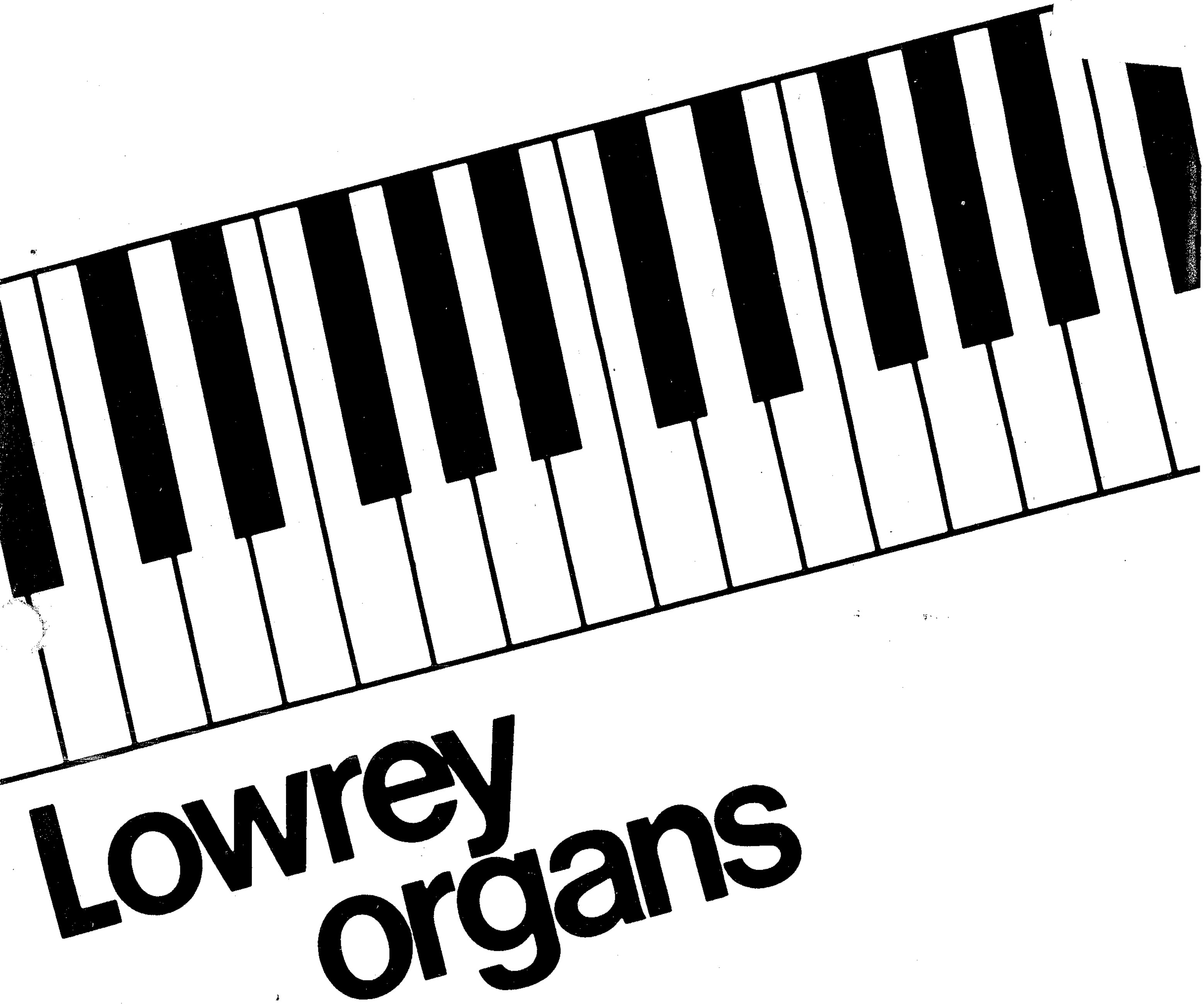
MODEL H25-4 / C500 SERVICE MANUAL



Lowrey organs

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H25-4/C500

SERVICE MANUAL

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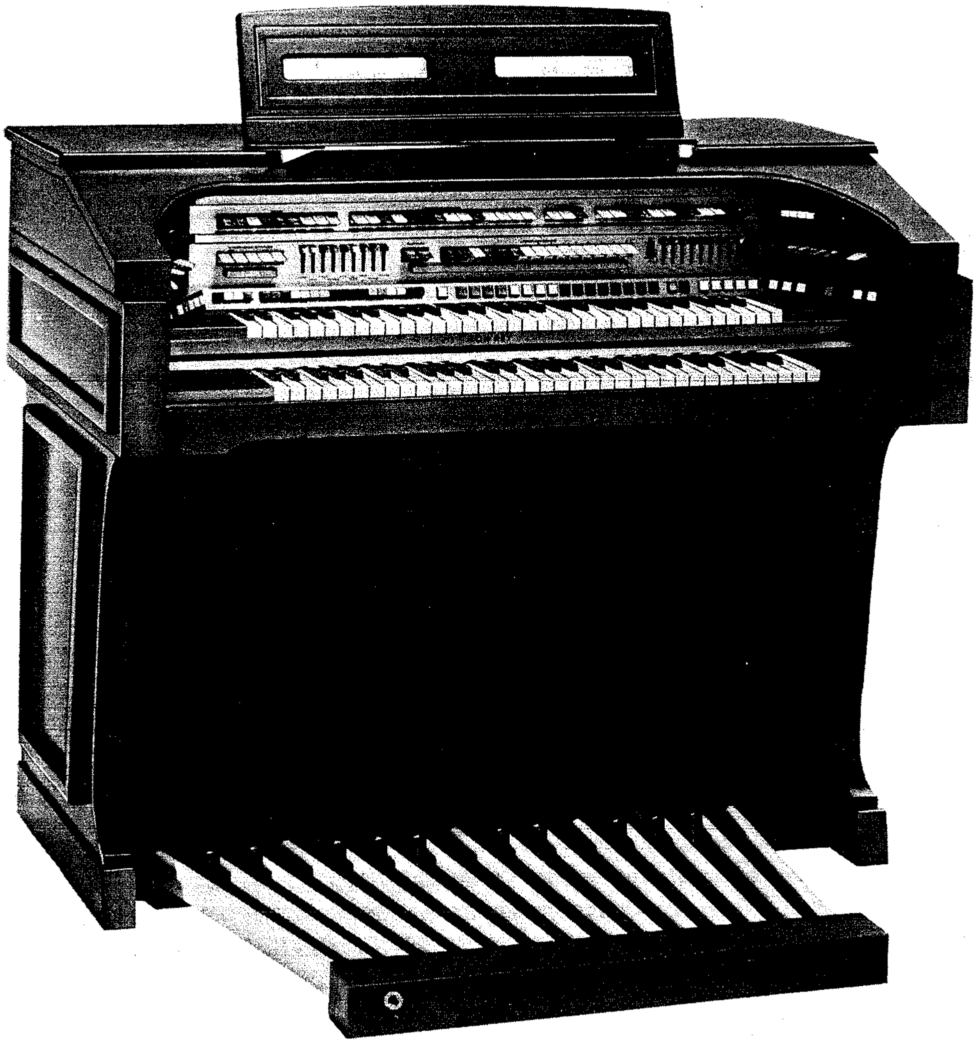
SPECIFICATIONS



H25-4/C500 FEATURES AND SPECIFICATIONS

Completely solid-state, self-contained, four-channel console organ with two 61-note keyboards and 25-note pedal board. The organ includes four amplifiers, seven speakers and four separate speaker channels.

2 - 61-note keyboards
1 - 25-note pedal keyboard
4 - Amplifiers - Main-Leslie-Chorus I-Chorus II

2 - 12-inch Bass Speakers
2 - 6x9-inch Chorus Speakers
1 - 10-inch Leslie Speaker
1 - 8-inch Main Speaker
1 - 3-inch High Range Tweeter Speaker

BASS

Pedals

Pedal Sustain
Pedal 16
Pedal 8
Diaphone 16
Pedal Wow

Keyboard Genie String Bass Genie Guitar Bass

PEDAL SYMPHONIZER

Orchestral to Pedals
Symphonizer 8 to 16
Tuba
Piano
Cello
Viola
Violina
Guitar

BASS VOLUME

Soft
Medium
Full
Loud

GENIE

Magic Genie Chords
Chord Hold
Guitar Strum
Ukulele Strum
Strum Downbeat
Piano Arpeggio
Harpsichord Arpeggio
Golden Harp
Boogie Woogie Bass

SYMPHONIC STRINGS

Upper	**Lower**
Cello 16	Viola 8
Viola 8	Violina 4
Violina 4	

SPECIFICATIONS

LOWER KEYBOARD
Genie Flutes
Genie Flute Accent
Piano
Guitar
Banjo
Ukulele
Genie Plus Organ
Diapason 8
Octave 4
Vox Humana 8
Flute 8
Flute 4
Flute 2-2/3
Flute 2

CHORUS

Flute Chorus
Chorus Celeste
Leslie Tremolo

PRESETS

Vibes
Vibra Harp
Hawaiian Guitar
Piano
Electric Piano
Harpsichord
Orchestral Clarinet
Accordion
Piccolo
Violin
Symphonic Wow
Wow Attack Slow

UPPER KEYBOARD

Trombone 16
Trumpet 16
Diapason 8
English Horn 8
Kinura 8
Vox Celeste 4
Flute 16
Flute 8
Flute 5-1/3
Flute 4
Flute 2-2/3
Flute 2
Flute 1-3/5
Flute 1-1/3
Flute 1

RHYTHM

Rhythm Start Auto
Rhythm Start

EFFECTS

Sustain Upper
Sustain Lower Flute
Repeat
Percuss Long
Percuss Full
Vibrato
AOC

GOLDEN HARP

Up
Down
Up/Down 2
Up/Down 3
Virtuoso
Rhythm Syncopation

PERCUSSION

Harmonic 4
Harmonic 2-2/3
Chiff
Marimba
Glockenspiel
Carillon
Celesta
Music Box

PRESETS

Flute #1
Flute #2
Flute #3
General #1
General #2

ORCHESTRAL SYMPHONIZER

Grand Piano
Honky Tonk
Harpsichord
Clavecin
Classic Guitar
Electric Guitar
Mandolin
Banjo
French Horn
Trombone
Post Horn
Trumpet
Trumpet Mute
Saxophone
Krumet Horn
Oboe
Cancel Upper
Lower Only

GENIE SYMPHONIC RHYTHM

Samba
Bosa Nova
Rhumba
Latin Rock
Rock I
Rock II
Rock III
Swing
Dixie
Shuffle
Country
Swing/March
March Polka
Swing Waltz
Waltz
Metronome
Snare Cancel
Rhythm Intro

RHYTHM

Bass Drum
Cymbal
Brush
Snare Drum

GENERAL CONTROLS

Orchestral Volume
Harp Speed
Reverb Length
Wow Range
Repeat Speed
Vibrato Depth
Vibrato Speed
Sustain Flute
Sustain Reed/String
String/Vox Lower
String/Vox Upper
Genie Strum
Genie Arpeggio
Lower Genie
Lower Diapason/Flute
Rhythm Speed
Rhythm Balance
Rhythm Volume
Orchestra 8
Orchestra 16-8
Orchestra 16

GENERAL FEATURES

48 - Major, Minor Seventh and Minor Seventh Chords
Expression Pedal
Golden Harp and Minor Chord Footswitch
Piano Sustain and Glide Footswitch
Master Volume Control on amplifier
Minimum Volume Control on amplifier
Auxiliary Input Jack
Tone Cabinet/Cassette Accessory Socket on amplifier

CIRCUIT DESCRIPTION

SCHEMATIC 1

VIBRATO TONE GENERATORS & DIVIDERS

The tone generators consist of the Master Oscillator Q8, the Top Octave Synthesizers IC2, IC3 and the IC Dividers IC4-IC15. The Master Oscillator creates a 2 MHz signal which is applied to the Top Octave Synthesizers IC2 and IC3. Here the signal is divided to create 13 specific octave frequencies which are applied to the IC Dividers where they are divided in half several times, creating lower octave frequencies. These audio signals are then routed to various diode and audio keying circuits. The Vibrato Oscillator shifts the frequency of the Master Oscillator to create the vibrato effect.

IC1A&B, Q2 VIBRATO DELAY TRIGGER, INVERTER & SWITCHER

Turning on Upper Keyboard preset voices, Vibra Harp, Piccolo, Violin Orchestral Clarinet or an Orchestral Symphonizer voice, enables IC1A by applying a positive voltage to Pin 2 of IC1A. Pressing an Upper Keyboard keyswitch, applies a positive voltage pulse to Pin 1 of IC1A causing its output to go low which develops a pulse across the .33 uf capacitor. This lowers the voltage on Inverter IC1B causing its output to go high which turns on Q2, momentarily grounding the vibrato oscillator creating the delayed vibrato effect. Pin 1 of IC1A is held high through the 22K resistor for the duration of the pulse across the .33 uf capacitor. Q2 is also switched on to cancel vibrato under the following conditions:
1.Turning on the Carillon percussion preset; 2. With an Orchestral Symphonizer* Piano preset on and 3. Pressing the Glide switch.

* Orchestral Symphonizer Piano preset refers to Grand Piano, Honky Tonk, Harpsichord and Clavecin voices.

Q1 ORCHESTRAL TO LOWER VIBRATO DELAY CANCELLER

With the Orchestral to Lower preset on, a positive voltage is applied to the base of Q1 turning it on. This prevents the enabling of IC1A from the Orchestral Symphonizer, cancelling the Vibrato delay effect on the Orchestral Symphonizer voices when they are played from the Lower Keyboard.

Q3, Q4 VIBRATO OSCILLATOR

The Vibrato Oscillator develops a continual low frequency (6.3 Hz) sine wave of sufficient amplitude to shift the frequency of the Master Oscillator high and low creating a vibrato effect. The oscillator output is applied to the Master Oscillator, CFG Master Oscillator Q353 via the vibrato tabswitch. It is also applied directly to the Tremolo Drivers Q27 & Q28.

Note: When the Vibrato tabswitch is turned on, the Vibrato Oscillator output bypasses the preset Vibrato circuit and the speed and depth of vibrato are controlled by the Vibrato Controls VR1 and VR2.

Q6 & Q7 VIBRATO ENABLERS & PRESET VIBRATO DEPTH CONTROL

The Hawaiian Guitar, Violin, Piccolo & Orchestral Clarinet voices have a preset vibrato with the Vibrato tab off. Turning on any of these tabs applies a positive voltage to the base at Q6. This turns off Q7 and allows the vibrato signal to pass to the Master Oscillator Q8. The depth of vibrato or the amplitude of the vibrato signal for each voice is controlled by changing the value of resistance to ground at Point G. The cathode of Diode D10 will be considered a ground for the purpose of description, although it is actually slightly negative. Turning on the Hawaiian Guitar tab applies a positive voltage through Diodes D4 & D6, this reverse biases Diodes D5 & D7 causing the amplitude of the vibrato signal to be controlled by the 5.6K resistor to ground. With the Violin or Piccolo tab on, a positive voltage is applied only to the cathode of Diode D7, the path through D5 is forward biased paralleling the 5.6K resistor with the 3.3K resistor, thus reducing the amplitude of the vibrato signal for these voices. Turning on the Orchestral Clarinet leaves both D5 & D7 in a forward biased state - the vibrato signal now 'sees' the paralleled combination of a 3.3K, 5.6K & 1K resistor which further reduces the vibrato depth for this voice.

Q5 GLIDE SWITCHER

Pressing the glide switch with the Orchestral Symphonizer Piano Presets* off, applies positive voltage to the base of Q5 turning it on. This detunes the Master Oscillator by one semi-tone and creates the glide effect.

Q8 MASTER OSCILLATOR

The Master Oscillator Q8 develops a continual 2 MHz signal which is applied to the Top Octave Synthesizers IC2 and IC3, via the Buffers Q9 and Q10.

Q9, Q10 BUFFERS

The buffers act as an isolation stage between the Master Oscillator and the TOS, preventing any change in Master Oscillator frequency due to change in circuit load.

CIRCUIT DESCRIPTION

IC2, IC3 TOP OCTAVE SYNTHESIZERS
IC4-IC15 DIVIDERS

High frequency audio signal is applied to IC2 and IC3 where it is divided simultaneously to produce thirteen specific audio frequency signals. These signals are connected to upper and lower keyboard keying circuits, and also to IC Dividers IC4-IC15, where they are divided in half several times to produce lower organ tones. The signal outputs are of a particular octave frequency and are shown boxed on Schematic 1. (The letter-number designation within these boxes refer to a specific octave frequency and should not be confused with a keyboard designation.)

SCHEMATIC 2

UPPER KEYBOARD R/S KEYING & CONTROL

UPPER KEYBOARD R/S DIODE KEYING

Pressing an upper keyboard keyswitch applies positive voltage via the upper R/S cancel circuit to the upper keyboard R/S diode keying circuits. This positive voltage is applied to the anodes of D23, 24 and 25, turning them on and allowing audio signal from the tone generators to pass the 4, 8 and 16-foot R/S diode keying groups. The 68K resistors for each footage are tied together in groups at their output and form the R/S Diode Keying Groups. The positive voltage from each keyswitch also charges a 30 uf sustain capacitor which discharges upon releasing a key and holds diodes D23-25 on. The discharge rate of this capacitor is controlled by the sustain length regulators.

UPPER KEYBOARD KEYDOWN BUFFER Q13

Pressing an upper keyboard key applies a positive voltage from the upper keyboard Keydown Latch Circuit IC93B to the base of Q13. This turns Q13 on, supplying the keydown pulse for Electric Piano, Vibrato Delay, Percussion, Mute, Sustain Cancel and Slow Attack control circuits. The positive voltage from IC93B also drives the Symphonic Wow circuit before being buffered.

R/S SUSTAIN LENGTH REGULATIONS

Sustain for the Upper Keyboard R/S voices is controlled by regulating the discharge rate of the 30uf capacitor connected to each R/S keying circuit. This capacitor is charged when holding a keyswitch down; upon releasing the keyswitch the capacitor discharges to the potential on the sustain control line. The remaining charge, if any, is then applied to the anodes of Diodes D23-D25 holding them on, allowing audio signal to continue to pass for the duration of discharge time. The discharge time is controlled by Q18 & Q19 as follows: Positive voltage is applied to the base of Q19 by turning on a voice with a preset sustain, or if the sustain upper tab is on, from the R/S Sustain Control VR10. The amplitude of Q19's base voltage is reflected by its emitter and provides the discharge reference for the 30uf sustain capacitor. The higher the emitter voltage the longer the sustain. Under a no-sustain condition, the base of Q19 is held low causing it to turn on. This applies a positive voltage to the base of Q18, turning it on which holds the sustain line at -4V. Upon releasing a key, any charge on the 30uf sustain capacitor discharges instantly to -4V. A no sustain effect is created.

SUSTAIN CANCEL

IC1C, IC1D & Q20 SUSTAIN CANCEL TRIGGER & SWITCHER

Turning on any voice with a diode connected to the sustain cancel line applies a positive voltage via the upper keyboard Buss Driver Q245 to Pin 9 of IC1C. This enables gate IC1C, allowing it to operate when an upper keyboard keyswitch is pressed. Pressing an upper keyboard key applies a positive pulse to Pin 10 of IC1C, causing its output at Pin 8 to go low. This develops a pulse across the .039 capacitor which pulls the input of Inverter IC1D low. The output of IC1D now switches high and turns on Switcher Q20, grounding the base of Q19. This turns on Q18 through Q19 and switches the sustain line to -4V causing any 30uf capacitor that had been charged by a previously played note to instantly discharge. This creates a one-note or monophonic sustain effect. Also, when the output of IC1D switches high, it holds Pin 10 of IC1C high for the duration of the pulse across the .039 capacitor.

SLOW ATTACK DRIVE

Q21 SLOW ATTACK MODULATOR DRIVER

Turning on any voice with a diode connected to the slow attack enable line applies a positive voltage to the Collector of Q21, allowing it to operate when an upper keyboard keyswitch is pressed. Pressing an upper keyboard key applies a positive voltage through a 2.2M resistor and charges a .068 capacitor. The RC time constant of this capacitor and resistor cause a slowly rising voltage to be applied to the base of Q21. This turns on Q21, applying a steadily rising voltage to Pin 5 of IC34 gating the signal through IC34, producing the slow attack effect.

CIRCUIT DESCRIPTION

WOW DRIVE

The Pedal and Symphonic Wow drive circuits are identical in operation. For description purposes the reference numbers for the Symphonic Wow drive circuit will be used. Normally the output Pin 10 of IC18C is high. When a positive pulse from the upper keyboard keydown latch IC93B occurs, the output of IC18C goes low, which switches the output of IC18D high.

The feedback between IC18C and IC18D makes them a Set/Reset Flip/Flop. At the same time the pulse from IC93B causes the Keydown Reset Q16 to discharge the .22 timing capacitor at the collector of Q17. The timing capacitor then charges through the Ramp Driver Q17 (giving a linear ramp). As the voltage on the capacitor increases, the output Pin 7 of IC19C follows it. When the output of IC19C is .6V higher than the voltage setting of the Range Control VR8 the output Pin 1 of IC19D (normally low) goes high, resetting the Set/Reset Flip/Flop causing the output of IC18D to go low. When IC18D goes low, the timing capacitor discharges through D33 and a 2.2M resistor. As the capacitor discharges, the output of IC19C follows it completing the drive waveform for the wow circuit for Symphonic Wow. The output of IC19C is applied to the Wow and Electric Piano filter allowing signal to pass through the filter at the amplitude of the drive waveform. For Pedal Wow the output of IC19A is applied to the Pedal Wow filter.

A positive voltage from the upper keyboard Keydown Buffer Q13 is R/C filtered, producing the Electric Piano Drive waveform. This waveform is then routed through Diode D36 to the Symphonic Wow & Electric Piano filter. Pressing the Upper Cancel switch applies a low to the cathodes of D18 and D19 which disables the Wow and Electric Piano drive circuits.

16-FOOT R/S TREMOLO DRIVE

ORCHESTRAL CLARINET & ELECTRIC PIANO LAMP DRIVER

Turning on the Orchestral Clarinet or Electric Piano tab applies a positive voltage to the base of Q25, turning it on. When Q25 turns on, it lowers the voltage on the base of Q26 turning it off, applying a positive voltage to the base of Q29 16-foot R/S Lamp Driver. Since Q29 is an emitter follower, its emitter also goes positive, lighting the Lamp in Photocell P1, allowing audio signal to pass to the R/S Mixing Preamp IC39A.

VIBES & VIBRA HARP LAMP DRIVE

Turning on the Vibes or Vibra Harp tab applies a positive voltage to the base of Switcher Q22 turning it on. When Q22 turns on, it performs two functions: 1) it turns off Q23, which allows a keydown pulse from the Keydown Buffer Q13 to pass through Q25 & Q26 to the base of Q29. This ensures a positive output from Q29 at keydown; 2) Q24 is switched off allowing the output of Q27 to pass to Lamp Driver Q29. Q27 is driven from the vibrato oscillator causing its output to be a low frequency sine wave. This varies the amplitude of Q29's emitter voltage and gives a tremolo effect to the audio signal passing through P1.

Q31-Q47 UPPER R/S SWITCHER DRIVERS

Positive voltage from the tabswitchers or from the general preset circuit is applied to the emitters of the switcher drivers. This voltage is greater than the base voltage causing the drivers to saturate. The positive collector output then turns on the FET switcher circuit for the chosen voice allowing audio signal to pass to various voicing circuits.

SCHEMATIC 3

UPPER KEYBOARD REED/STRING & SYMPHONIC STRING FILTERS

Audio signal from the tone generators via the upper R/S keying circuits is divided into half octave groups for filtering. The octave frequency range for each group is shown boxed on Schematic 3. After filtering, the output of each filter is combined and amplified before being sent to other voicing circuits where the character of each voice is created. The 4, 8 & 16-foot groups are combined through 8.2K resistors and routed to R/S collector amps.

PICCOLO

The Piccolo filters are three-pole low-pass filters, the output of each filter is tied together and, if the Piccolo tab is on, the audio signal is routed through Switcher Q51 to the input of the Piccolo Amp IC27B. Here the signal is inverted and amplified before being applied to the Slow Attack Modulator. The 4-foot R/S signal is formed by combining each audio group through 8.2K resistors. This signal is then inverted and amplified by IC27A. Turning on 4-foot R/S tabswitch turns on Switcher Q52 allowing this signal to pass to various upper keyboard 4-foot R/S voicing circuits.

UPPER KEYBOARD DIAPASON

The Diapason filters are three-pole low-pass filters, each feeding into the inverting input of an operational amplifier with a unity gain factor. The signal is then combined at the output of the op-amps and turning on the upper Diapason tab allows the signal to pass through Switcher Q53 to the non-inverting input of the Diapason amp. Here the signal is amplified by a gain factor of 11 and routed to the R/S mixing preamp and also to the percussion chorus preamp. The 8-foot R/S signal is formed by combining each audio group through 8.2K resistors. This signal is then inverted and amplified by IC26C. Turning on an 8-foot R/S tabswitch turns on Switcher Q54 allowing this signal to pass to various upper keyboard 8-foot R/S voicing circuits.

ORCHESTRAL CLARINET, ELECTRIC PIANO, VIBES & VIBRA HARP

The 16-foot filters are three-pole low-pass filters, each feeding into the inverting input at an operational amplifier with a unity gain factor. This signal is combined at the outputs of the op-amps and routed to the 16-foot collector amp. Here the signal is amplified and applied to the input of Photocell P1. The photocell allows a tremolo effect to be given to the audio signal for the Vibes and Vibra voices. For the Orchestral Clarinet and Electric Piano voices the photocell is held on by a steady DC voltage allowing the signal for these voices to pass without a tremolo effect. The audio signal for the low 16-foot octave C1-B1 is not available from the tone generators. This audio signal is developed by the low-octave keying circuit filtered and routed to the 16-foot Collector Amp, IC29A. The 16-foot R/S signal is formed by combining each audio group through 8.2K resistors. This signal is then inverted and amplified by IC26D. Turning on a 16-foot R/S tabswitch turns on Switcher Q57 allowing the signal to pass to various upper keyboard 16-foot R/S voicing circuits. The low octave R/S signal, C1-B1 is developed by the low-octave keying circuits and is then routed to IC26D and also the Cello 16 filters.

UPPER SYMPHONIC STRINGS

Each footage of Symphonic Strings is filtered in half-octave groups and routed to a collector amp. Here the signal is inverted and amplified. Turning on an upper Symphonic String tab allows this signal to pass through its associated FET switcher to the Upper String Volume Control VR13. At the output of the volume control, the audio signal is routed to the chorus modulator circuit where it is phase modulated - creating the Symphonic String effect.

Q56 GENERAL PRESET R/S SWITCHER

Turning on a general preset applies a positive voltage through Q56 to the 4, 8 & 16-foot R/S switchers. This turns on these FET switchers and allows audio signal to pass to various voicing circuits. Since there is no way to determine what voices will be called for by the general presets, audio signal must be routed to all the voicing circuits that can be general preset.

FET SWITCHERS

All FET switchers used are N-Channel depletion mode devices (normally conducting). They are pinched off by a negative voltage at their gate. Turning on the voice associated with each switcher applies a positive voltage to the gate of the FET cancelling the negative voltage, allowing them to return to their unbiased state. This permits the audio signal from the collector lines to pass to various voicing circuits.

Q55 OUTPHASER SWITCHER

Turning on the Orchestral Clarinet, Hawaiian Guitar or Accordion voice turns on Outphaser Switcher Q55. This combines the 8-foot R/S output with 16-foot R/S audio. This signal is then amplified by the 16-foot collector amp, and routed to filter circuits for the above-mentioned voices.

SCHEMATIC 4

REED/STRING QUALITY CONTROL

Audio signal from the R/S signal lines and Genie Volume Control is routed to various filtering circuits where the character of each voice is created. The output of each filter circuit is then routed through the R/S mixing preamp to reverb and main volume regulator circuits. The output of the Piano/Trombone filter is also routed to the Percussion Chorus Preamp where the signal is phase modulated and routed through tabs to the R/S Mixing Preamp IC39A. The Trumpet filter is used to filter Orchestral Clarinet and Hawaiian Guitar audio signal. The Hawaiian Guitar gain switcher lowers the amplitude of the input signal to the Trumpet Amp IC35B when the Hawaiian Guitar tab is on.

IC34 & IC35A SLOW ATTACK MODULATOR & VOLTAGE FOLLOWER

Violin, Accordion and Piccolo are the Slow Attack voices of the organ. Turning on any of these tabs applies signal to the input (Pin 3) of IC34. Signal is gated through IC34 when positive voltage is applied to pin 5 from the Slow Attack Modulator Driver Q21. This creates the Slow Attack effects for these voices. The signal is then applied to the input of IC35A where it is transformed into a low impedance signal, before being applied to the R/S Mixing Preamp IC39A.

IC37, IC38, Q77, Q78 ELECTRIC PIANO & SYMPHONIC WOW FILTER AND EMITTER FOLLOWERS

This circuit is a State Variable Filter that acts in conjunction with the 800P capacitors to form an RC low pass filter. Signal from the R/S 16 signal line is gated through the filter at the amplitude of the drive waveform applied to Pin 5 of IC37 and IC38. The output is a low impedance signal that is routed to the R/S Mixing Preamp when the Electric Piano tab is turned on. Turning on the Symphonic Wow tab routes the signal to the Chorus Mixing Preamp.

SCHEMATIC 5

There are 61 lower R/S keyswitches the C1-C4 and C#4-C6 keyswitches having a separate keyswitch on buss. Pressing a C1-C4 keyswitch applies voltage to a diode keying circuit through Diode D135, a 470 ohm resistor and Coil L3. Pressing a C#4-C6 keyswitch applies voltage to a diode keying circuit through a 470 ohm resistor and Coil L4. This voltage biases on Diodes D133 and D134, allowing audio signal to pass to the lower R/S groups. These groups are represented by a bold line on Drawing 6. A positive voltage is also applied to the manual Rhythm Trigger Q400 when a C1-C4 keyswitch is being held.

With the Magic Chord on, the A1-A2 lower R/S keyswitches are disabled by grounding the cathodes of Diodes D120-D132. Pressing a key in this range at this time outputs a chord from the Chord Function Generator which is routed to the lower keyboard filtering circuits. Also, when in the chord mode the A2 keyswitch becomes the 7th switch. Pressing the A2 keyswitch at this time applies positive voltage to the 7th Enable Q340 which adds the 7th component to the Magic Chord being played.

RHYTHM START

Placing the Rhythm Start tab in the on position resets Rhythm Start Flip-Flop IC42B. This causes the Q bar output to go high turning on Rhythm Start Switcher Q85, lowering the voltage on the base of the multi-starter which enables the rhythm to start.

AUTO RHYTHM START

Turning on the Auto Start tab (Rhythm Start tab off) performs two functions: 1) the set input of IC42B goes high allowing IC42B to be clocked and 2) the output of the Keydown Detector Q84 is connected to Inverter IC41A. Pressing a lower manual keyswitch lowers the voltage on the base of Q84 turning it on. The high level at the Collector of Q84 is inverted through IC41 and resets Flip-Flop IC42B. This causes the Q bar output of IC42B to go high, turning on Switcher Q85 which enables the rhythm to start. If the lower keyboard keys are released and the counter output from IC200 is high, indicating the first half of a rhythm measure, the rhythm will continue to play to the end of that measure. If the counter output is low, this indicates the last half of a rhythm measure and the rhythm will continue to play to the end of the following measure. This is accomplished by the following: To stop the Rhythm Pin 11 of IC41D must make a positive transition, clocking IC42B. IC42A is in a reset condition (Q output low), this locks the output of IC41D high. With the keys released, the output of IC41A and Pin 4 of IC41C are high. If the keys are released when the counter output is low the above conditions remain unchanged. If the counter output is high, the output of IC41C goes low. This sets IC42A applying a high level to Pin 12 of IC41D. The output of IC41D remains unchanged at this time. The next negative transition of the counter is inverted through IC41B and applied to Pin 13 of IC41D. Both inputs to IC41D are now high and its output goes low. This has no effect on the output state of IC42B. On the next positive transition of the counter, the high Q output at Pin 5 of IC42A is reinstated while the positive transition of the counter is inverted through IC41A.

This causes the inputs to IC41D to be opposite and its output goes high clocking IC42B. This causes the Q bar output Pin 8 of IC42B to go low turning off Switcher Q85 which stops the rhythm. Also, when Pin 8 goes low it resets IC42A. This ensures that IC42A will always be in a reset condition (Q low) at the onset of the Auto Stop sequence.

Note: After releasing the keys, the counter must make a negative transition then a positive transition, in that order, before the rhythm shuts off. This causes the turn-off time to vary depending on the state of the counter output when the keys are released.

Q86-Q95 LOWER R/S SWITCHER DRIVERS

Positive voltage from the lower R/S tabs or the General Preset circuit is applied to the emitters of the lower R/S switcher drivers. This voltage is greater than the base voltage causing the drivers to saturate. The positive collector output then turns on the FET switcher circuit for the chosen voice allowing signal to pass to the various voicing circuits.

SCHEMATIC 6

LOWER KEYBOARD DIAPASON & SYMPHONIC STRING FILTERS & GENIE MODULATOR

Audio signal from the Tone Generators via the lower R/S keying circuits is divided into half octave groups for filtering. The octave frequency range for each group is shown boxed on Schematic 6. After filtering the output of each filter is combined and amplified before being sent to various voicing circuits. The 4 and 8-foot groups are combined through 8.2K resistors and routed to R/S collector amps.

LOWER KEYBOARD DIAPASON

The Diapason filters are three-pole low-pass filters each feeding into the inverting input of an operational amplifier with a unity gain factor. The signal is then combined at the output of the op-amps and turning on the lower Diapason tab allows the signal to pass through Switcher Q98 to the lower Diapason and Octave 4 Volume Regulator IC49. In the Magic Chord mode, the output of the Magic Chord preamp is applied to the input of Filter IC45B. Here the signal is routed to the Diapason and 8-foot R/S collector lines.

OCTAVE 4

The Octave 4 filters are three-pole low-pass filters, each feeding into the inverting input of an operational amplifier with a unity gain factor. The signal is then combined at the output of the op-amps, and turning on the Octave 4 tab allows the signal to pass through Switcher Q99 to the lower Diapason and Octave 4 Volume Regulator IC49. In the Magic Chord mode, the output from the Magic Chord 4-foot TOS is applied to the input of Filter IC46C. Here the signal is routed to the Octave 4 and 4-foot R/S Collector Lines.

IC49 & Q100 LOWER DIAPASON & OCTAVE 4 VOLUME REGULATOR & EMITTER FOLLOWER

Audio signal from the Diapason and Octave 4 filters is applied to Pin 3 of IC49. The amplitude of the voltage applied to Pin 5 of IC49, from the lower Flute volume pot, controls the amplitude of the output signal at Pin 6 of IC49. This signal is then applied to Emitter Follower Q100 where it is transformed into a low impedance signal before being routed to the R/S Mixing Preamp IC39A.

IC29B&C LOWER 4 & 8 R/S COLLECTOR AMPS

The 4- & 8-foot R/S signals are produced by combining the audio signal groups through 8.2K resistors. These audio signals are then applied to their respective collector amps where they are amplified and inverted. The 8-foot R/S output from IC29B Pin 7 is routed to the Vox Humana filter, and if a lower 8-foot R/S voice is on, through Switcher Q101 to the Genie Modulator IC50. The 4-foot R/S output from IC29C Pin 8 is routed to the Vox Humana filter, and if a lower 4-foot R/S voice is on, through Switcher Q102 to the Genie Modulator IC50.

VOX HUMANA

Audio signal from the 4- & 8-foot R/S Collector Amps is simultaneously filtered by the Vox Humana Filter IC30B&C. This filtered audio signal is then combined and routed to the Vox Humana Mixing Preamp Q103, where it is amplified and routed to the Vox Humana Switcher Q104. Turning on the Vox Humana tabswitch allows the signal to pass through Q104 and the lower String Volume Control VR17 to the Chorus Mixing Preamp IC28C.

GENIE MODULATOR

Audio signal from the lower 4- and 8-foot R/S Collector Lines is applied through Switchers Q101 & Q102 to Pin 3 of the Genie Modulator IC50. Signal can only pass through IC50 when a positive voltage is applied to Pin 5. With the rhythm off, Genie Accompaniment Switcher Q106 is off and a positive voltage is routed through the Genie Voices tab to Pin 5 of IC50. This allows audio signal to have a constant path through IC50. Turning on the Genie Voices tab at this time will have no audible effect. With the Rhythm Start tabswitch on, a positive voltage from the Rhythm On Switcher Q351 is routed to the base of Q106. This turns Q106 on, which allows positive voltage pulses from the Genie Modulator Driver to pass through D161 and the Genie Voices tab to Pin 5 of IC50. This gates the audio signal through IC50 in time with the Rhythm. Turning on the Genie Voices tab at this time applies a steady positive voltage to Pin 5, giving the capability of playing the lower R/S voices unmodulated when using the rhythm section.

With the Rhythm Auto Start tabswitch on, Q105 Auto Stop Chord Hold Killer is turned on applying a positive voltage to the base of Q106. This positive voltage performs the same function as the voltage from the Rhythm On Switcher did in the normal Rhythm Start mode of operation. To explain the purpose of Q106, assume the following condition: Magic Chord On, Chord Hold On and Lower Keyswitch just released. Under the above conditions the rhythm will continue to play for a short time. When the Rhythm shuts off, the output from the Rhythm On Switcher through D160 goes low. If not for Q105, this would cause Q106 to shut off, biasing on Modulator IC50. Since, in the Chord Hold mode of operation, the Chord Function Generator will continue to put out the chord information. This information would pass through Modulator IC50 and the last chord held would continue to play. Q105 prevents this condition by holding on Q106 when in the Auto Rhythm Start mode of operation. When Q106 shuts off (Rhythm on) it also enables the Genie Accent Drivers if the Genie Flute and Genie Accent tabswitches are on.

Q107 & Q108 RHYTHM PULSE DETECTOR & GENIE FLUTE DRIVER

With the Rhythm on and Genie Flute tab on, output from the Genie Modulator Driver Q378 is inverted through Q107 and applied to the base of Q108. When the output from Q378 is high, Q108 is off and lower Flute data is allowed to pass through Gate IC91A. When the output of Q378 is low Q108 turns on disabling Gate IC91A, blocking the lower Flute data. This allows the lower keyboard Flute voices to play in time with the Rhythm.

LOWER SYMPHONIC STRINGS

Each footage of Symphonic Strings is filtered in half-octave groups and routed to a collector amp. Here the signal is inverted and amplified, turning on a lower Symphonic String tab allows this signal to pass through its associated FET Switcher to the lower String Volume Control. At the output of the Volume Control the audio signal is routed to the Chorus Modulator circuit, where it is phase modulated creating the Symphonic String effect.

SCHEMATIC 7

UPPER & LOWER KEYBOARD 16-FOOT LOW-OCTAVE KEYING

(Schematic References for Lower Keyboard used for description purposes where Upper & Lower Keyboard circuits are identical.)

The purpose of the low-octave keying circuits is to provide the octave frequencies for the 12 lowest 16-foot notes. There are no 16-foot lower keyboard voices; the lower keyboard low-octave keyswitches are only used when playing the Orchestral Symphonizer from the lower keyboard, with the Orchestral Symphonizer footage selector switch in the 16-foot position.

KEYDOWN DETECTORS

Pressing an upper or lower keyboard low-octave keyswitch applies positive voltage to the emitter of a PNP keydown detector transistor. Because of the lower base potential this transistor conducts, applying positive voltage, via the keying line, to a PNP keyer and also through a 560K resistor to the anode of a diode allowing audio signal to pass, via the collector line, to the low-octave collector amp. The low-octave keyswitches have a low-priority - meaning the lowest note being held will sound. For example, looking at the lower keyboard low-octave keyswitches: If the B1 keyswitch were being held Q126 would be saturated. Pressing the A#1 keyswitch (or any keyswitch below B1) at this time, would cause Q125 to turn on. Its base voltage will cause Diode D180 to turn off. This virtually leaves the base of D126 open, shutting it off.

CANCEL TRIGGER

Pressing a low-octave keyswitch develops a pulse across the 1 uf capacitor connected to the low-octave keyswitch buss. This momentarily lowers the voltage on the base of Q113, turning it off. When Q113 turns off, it applies a positive voltage pulse to the base of Q114; this causes Q114 to turn on, momentarily grounding the Keying Line which discharges any previously charged 5.6 uf capacitor. This turns off the signal path of the previously played note making sure that only the signal from the note being played enters the Low-Octave Divider IC52. (If more than one signal at a time enters the Divider, rumble will occur.)

16-FOOT LOW-OCTAVE KEYER

Playing a low-octave keyswitch applies a positive voltage through a Diode D185 to the base and emitter of Low-Octave Keyer Q127. This causes Q127 to conduct, enabling the low-octave trigger circuits.

COLLECTOR AMPS

Audio signal from the Tone Generators is applied to the collector amps each time a low-octave keyswitch is pressed. The collector amps amplify this signal, providing a sufficient drive signal for the low-octave divider. Here the audio signal is frequency-divided in half before being applied to various low-octave keying circuits.

UPPER & LOWER KEYBOARD 16-FOOT LOW-OCTAVE ORCHESTRAL SYMPHONIC KEYING

Depending on the state of the Orchestral to Lower Preset, either Q145 or Q147 is enabled, allowing divided audio signal to pass to the low-octave Orchestral Symphonic keying circuit. The state of the Orchestral to Lower Preset also determines the path for the keying voltage to the Orchestral Symphonic trigger. With Orchestral to Lower "on" Q146 is off and Q148 is saturated, allowing the voltage from Keyer Q127 to reach the base of Q151. With Orchestral to Lower "off" the states of Q146 and Q147 are reversed and the voltage from Keyer Q144 is routed to the base of Q151. Assuming an Orchestral Symphonic Preset is on, this keyer voltage turns on Q151 which turns on Q152 and supplies the keying voltage to the Brass and Piano/Guitar keying lines. From this point the operation of the low-octave Orchestral Symphonic keying circuit is identical to that described under the

Schematic 24 heading for Orchestral Symphonic Keyer and Pulse Keyer Q510 & 512. The only exception is that the output from Q153 cannot pass to the Pulse Keyer circuit unless the Orchestral switch is in the 16-foot (or both) position, turning on Enable Transistor Q154.

UPPER KEYBOARD 16-FOOT LOW-OCTAVE FLUTE, R/S & PERCUSSION KEYING

Pressing an upper keyboard low-octave keyswitch applies a positive voltage from Q144 to the base of Q149. Assuming the cancel upper is off, this causes Q149 - and in turn Q150 - to turn on applying voltage to the 16-foot low-octave R/S, Flute and Percussion Keying Lines. The voltage applied to the R/S keying line biases on Diodes D219 & D220 allowing audio signal to pass to the 16-foot R/S collector line and the Cello 16 filter. At the same time this voltage charges a 10 uf sustain capacitor. The discharge rate at this capacitor is controlled by the R/S sustain regulators (see circuit description under Schematic 2 heading for Q18 & Q19).

The voltage applied to the Flute Keying Line turns on Low-Octave Flute Keyer Q156. If a 16-foot Flute type voice is turned on, Q158 is turned off through Q157 allowing the positive voltage output from Q156 to bias on Diodes D221 & D222. This allows audio signal to pass to Flute Filter IC162A.

The voltage applied to the percussion keying line is differentiated by a .22 capacitor applying a positive voltage pulse to the base of Q159. If the Glockenspiel voice is on, a positive voltage is applied to the base of Q160 through IC76B. This turns on Q160 shutting off Q161, allowing the positive pulse from the collector of Q159 to bias on Diodes D226 & D227. This allows audio signal to pass to the Percussion Filter IC176A for the duration of the pulse. The length of this pulse is controlled by the Snub Regulator. (See description of Q271 under Schematic 11 heading.)

SCHEMATIC 8

PEDAL SYMPHONIZER KEYING & CONTROL

Pressing a bass pedal causes the following:

1) A pulse is developed across the .22 capacitor (connected to the C1 Pedal Switch) causing the Pedal Cancel Trigger to operate.
2) A generator output Diode D231 is biased on, allowing tone generator signal to pass through D232 or D333 to the base of Pedal Collector Amp Q179 or Q180.
3) A 5.6 mfd capacitor is charged, which holds the Generator Output Diode on after the pedal has been released.
4) The Pedal Keydown Detector conducts, supplying the enable voltage for the Pedal Shimmer Generator, Pedal 8/16 Trigger, Orchestral Symphonic Trigger, Mute and Detuning Trigger and T/P/G Trigger.

Q164, Q165 PEDAL CANCEL TRIGGER

Pressing a pedal develops a pulse across the .22 capacitor connected to the C 1 Pedal Switch. This momentarily lowers the voltage on the base of Q164, turning it off. When Q164 turns off, it applies a positive voltage pulse to the base of Q165. This causes Q165 to turn on, momentarily grounding the Pedal Keying Line which discharges any previously charged 5.6 uf pedal sustain capacitor. This turns off the signal path of the previously played pedal making sure that only the signal from the pedal being played enters the Pedal Divider. (If more than one signal at a time enters the Pedal Divider, rumble will occur.) The positive output from the collector of Q164 is also used to trigger the Pedal Wow and Pedal Rhythm circuits.

Q179 & Q180 HIGH AND LOW OCTAVE PEDAL COLLECTOR AMPS

High octave pedal signal (C2-C3 Pedal Switches) and Low octave pedal signal (C1-B1 Pedal Switches) is applied to the base of their associated Pedal Collector Amp. Here the signal is amplified, providing the drive signal for the pedal divider. The collector inputs from Q179 & Q180 are routed to keying circuits for the 4-foot Pedal Violina voice before being divided. The divider outputs provide the audio signal for the 8- & 16-foot pedal voices. The 8-foot outputs are also routed to the Orchestral Symphonic Pedal Keying circuit for use when the Orchestral to Pedal preset is on.

Q181 PEDAL KEYDOWN DETECTOR

Playing a bass pedal applies a positive voltage to the emitter of Q181, because of its lower base potential Q181 turns on. This applies a positive voltage to the Pedal Shimmer Generator, Pedal 8/16 Trigger, Pedal Orchestral Symphonic Trigger, Mute and Detuning Trigger and T/P/G Trigger enabling these circuits to operate.

PEDAL 8, PEDAL 16 & STRING KEYING

Pressing a pedal applies a positive voltage from the collector of Q181 to the base of Q190. This turns on Q190, lowering the voltage on the base of Q191 which also turns on. When Q191 turns on, a positive voltage is applied to the base of Q192 & Q193. These two keyers turn on applying positive voltage to the diode readout circuits at their emitters. This allows audio signal from the Pedal Divider to pass to the Pedal String & Pedal 8/16 filter circuits. The capacitors at the base of Q192 & Q193 are charged by Q191. If sustain is off, these capacitors discharge through a resistor and Diodes D251 & D252 to ground. If sustain is on, ground is removed from the cathodes at D251, and D251 and the capacitors discharge onto the base of Q192 & Q193 holding them on. This allows audio signal to pass to the filtering circuits for a short time after the pedal has been released creating the pedal sustain effect. The positive output from the emitter of Q193 is also applied to the base of the Genie Bass Killer Q225.

PEDAL SYMPHONIZER LATCHES

Each Pedal Symphonizer latch consists of a switch, inverter and a "D" Flip-Flop. IC54 & 57 are Hex Schmitt triggers which have a specific threshold voltage. Pressing a preset switch drops the input of the Schmitt triggers below their negative threshold resulting in a high at the output. As the switch is held in, a phenomenon called switch bounce occurs. The switch bounces and the .1 capacitor charges and discharges, but the voltage never reaches the positive threshold of the Schmitt triggers and the output remains high until the pushbutton is released. (If a normal inverter were used in this circuit, its output would change with each bounce of the switch. This would trigger the clock inputs of the "D" Flip-Flops an indeterminate number of times, making it impossible to determine their end state. When the outputs of the Schmitt triggers go high, they apply a pulse to the clock input of a "D" Flip-Flop. The Flip-Flops are normally in a reset condition - Q low and Q bar high. After clock, both outputs change state and will remain in this condition until the same preset is pressed again applying another pulse to the clock input of the "D" Flip-Flops. In the case of the Tuba, Piano & Guitar pedal voices, pressing any one of these presets will apply a negative reset pulse (through Diodes D239-D246) to the other two "D" Flip-Flops, resetting their outputs and cancelling any preset that was previously on.

SWITCHER DRIVERS & LAMP DRIVERS

When a Pedal Symphonizer preset is active, the Q bar output goes high turning on a Lamp Driver which lights the lamp in the preset switch. The positive Q bar output is also applied through a switcher driver transistor turning on the FET switcher associated with the preset. This allows the pedal audio signal to pass to various voicing circuits.

ORCHESTRAL TO PEDAL

With the Orchestral to Pedal preset on, a positive voltage from the Q bar output of IC56B turns on Q184 & Q186. With Q186 on, Q185 is enabled and when a pedal is pressed a positive voltage is applied from the collector of Q181 through Q185. This voltage is routed to the Trumpet Mute Drive circuit and is also applied as a detuning pulse to the Master Oscillator, when the Orchestral Symphonizer voices using these effects are on.

With Q184 on, the Orchestral Symphonizer trigger is enabled by grounding the emitter of Q183. When a pedal is pressed, a positive voltage is routed to the base of Q183 from Q181. If at this time an Orchestral Symphonizer preset is on, collector voltage is supplied to Q183 from the Orchestral Symphonizer Driver and Q183 turns on. This lowers the voltage on the base of Q182, turning it on supplying positive voltage to the Orchestral Symphonizer pedal keyer circuit. The Orchestral Symphonizer pedal keyer circuit operates allowing audio signal to pass to the Orchestral Symphonizer filter circuits.

TUBA/PIANO/GUITAR KEYING

With the Tuba, Piano or Guitar preset on, a positive voltage from the Q bar output of IC58B, 59A or 59B turns on Q189. This enables the T/P/G trigger by grounding the emitter of Q188. When a pedal is pressed, a positive voltage is routed to the base of Q188 from Q181. This turns on Q188 lowering the voltage on the base of Q187 which also turns on. This voltage is routed via the enabled keying line to the base of the T/P/G Keyer Q198.

With the Piano or Guitar on, Q194 is off and the positive output from Q187 passes via the Piano/Guitar keying line and is applied as a pulse to the base of Keyer Q198. This positive voltage also turns on Q195 disabling the Tuba keying line. When the Tuba voice is on, a positive voltage is routed to the base of Q194 from IC58B Pin 8. This turns on Q194 grounding the Piano/Guitar keying line. The keying voltage from Q187 now passes via the Tuba keying line to the base of the T/P/G keyer.

The Piano & Guitar Snub Switchers Q196 & Q197 are turned on when their associated voice is on. Turning either of these switchers on produces a voltage divider network at the cathode of Diode D281, supplying the keydown discharge reference for the .22 capacitor at the base of Q198. Upon releasing a pedal, positive voltage is removed from the cathode of Diode D278 and any remaining capacitor charge is routed through an 82K & 18K resistor to ground. With pedal sustain on, positive voltage is applied to the cathode of D278 holding D278 in a reversed bias condition. Releasing a pedal at this time causes the .22 capacitor to discharge onto the base of Q198 holding it on which creates a sustain effect.

The voltage applied to the base of Q198 from either the Tuba or Piano/Guitar keying lines, turns Q198 on applying positive voltage to the high and low octave pulse keyer circuits. The output from Q198 biases on Diodes D286 & D290 allowing audio signal from the T/P/G preamps to pass to the Piano & Tuba filters. Q198 also enables the High and Low Octave Pulse Keyers Q201 & Q202 which produce a pulse waveform of diminishing amplitude at the frequency of the input signal from the high and low octave preamps. The pulse keyer outputs are then routed to the Guitar strike tone and pulse filters.

With the Pedal Symphonizer 8 to 16 switch off, the Q bar output of IC58A is low and the 16-foot audio signal from the pedal divider is grounded through Diodes D275 & D274. Turning on the Pedal Symphonizer 8 to 16 switch causes the Q output of IC58A to go low grounding the 8-foot audio signal from the pedal divider through Diodes D277 and D276. The audio signal that is allowed to pass is applied to the bases of the High and Low Octave Preamps Q199 & Q200 where it is amplified before being routed to the sawtooth and pulse keyer circuits.

SCHEMATIC 9

PEDAL SYMPHONIZER VOICING & GENIE BASS

PEDAL STRING

Audio signal from the Pedal Divider via the Pedal String keying circuits is applied to the Pedal String R/C filter networks. Turning on any of the Pedal String voices allows this audio signal to pass through its associated FET switcher to the Pedal String collector line. Depending on which of the Pedal Volume switches is on, the resistance to ground at the output of the Pedal String collector line is varied, regulating the amplitude of the String output signal. This signal is then routed through the Pedal String Amp IC28B to the chorus modulator where it is phase modulated before being routed to the amplifier circuits.

TUBA/PIANO/GUITAR FILTERS

The output from the high and low octave pulse keyers is applied to the Guitar Pulse Filter and Strike Tone Amp. The initial Guitar Strike Tone Pulse is applied through Strike Tone Amp IC62A where the length of the pulse is regulated by the DC level at Pin 5 of 62A. The output of IC62A is then applied to the Strike Tone Filter. The remaining output (after strike) from the pulse keyers is of a lower amplitude which cannot overcome the DC level setting of the strike tone amp and is blocked from passing through IC62A. This pulse waveform is applied to the Guitar Pulse Filter. If the Pedal Guitar voice is on, the filtered audio signal from the pulse and strike tone filters is routed through FET Switcher Q213 to the Pedal Mixing Preamp IC61D.

Audio signal from the sawtooth keying circuits is routed to the Piano/Tuba filter. Here the signal is filtered and if the Piano or Tuba preset is on, passes through FET Switcher Q214 to the Pedal Mixing Preamp IC61D.

LOWER KEYBOARD GENIE BASS

Q218-Q220 HIGH & LOW BASS SELECTORS

With a Rhythm on, the output from Pin 26 of the ROM IC201 is applied to the base of Q218 and Q219 through the Rhythm Start tab contacts. When Pin 26 is high, the High Bass note from Pin 6 of the CFG IC183 is grounded out through Q218 and the Low Bass note from Pin 7 of the CFG is allowed to pass to the base of Divider Driver Q221. When Pin 26 goes low, Q220 is turned on through Q221, grounding out the Low note allowing the High note to reach Q221. With no Rhythm on, the bases of Q218 and Q219 are held high allowing only Low Bass signal to pass to Q221. In the Boogie Woogie Bass mode, a positive voltage is routed from the Magic Chord tab to the bases of Q218 and Q219, allowing the signal output from Pin 7 of the CFG to reach the base of Q221.

Note: In the Boogie Woogie mode of operation, there is no audio signal output from Pin 6 of the CFG. The positive voltage from the Magic Chord tab holds Q220 off, assuring a constant signal path for the Low-Root output Pin 7 of the CFG.

Q221, PART OF IC200, DIVIDER DRIVER & GENIE BASS DIVIDER

Audio signal from Pins 6 & 7 of the CFG IC183 is applied to Q221 where it is amplified. This signal is applied to the Genie Bass Divider IC200 where it's frequency divided exactly in half. The signal output from the Divider is then applied to the Genie Bass Keyer Q222.

Q216, Q217 GENIE BASS PULSE DETECTOR & GENIE BASS DRIVER

Turning on a rhythm triggers the Bass Pulse Detector from the Boogie Woogie Bass Triggers or Pin 22 of IC201 (depending on the position of the Boogie Woogie Bass tab). When the trigger is low, voltage on the base of Q216 is lowered, causing it to conduct. A positive voltage is then applied to the base of Q217, causing it to conduct which applies positive voltage to the Genie Bass Keyer Q222, gating the base signal through the keyer at the speed of the rhythm. When the trigger goes high, Q216 turns off, causing Q217 to turn off, shutting off the signal path through the Genie Bass Keyer.

With the rhythm off, the cathode of Diode D301 is grounded. This lowers the voltage on the base of Q216, turning it on, which applies a steady positive voltage to Q217, holding it on, creating a constant signal path through the Genie Bass Keyer Q222, allowing the Low Bass signal to pass unmodulated. Note: With the rhythm off, the cathode of D302 is also grounded. This creates a voltage divider network through the 560 ohm and adjusts the DC level on the base of Q217.

Q222 GENIE BASS KEYER

Audio signal from the Genie Bass Divider is applied to the Genie Bass Keyer Q222. Each time a positive pulse from the Genie Bass Driver Q217 is applied to Q222, it allows audio signal to pass through Q222. This signal is then applied to the Genie Bass Emitter Follower Q223.

Q223 & Q224 GENIE BASS EMITTER FOLLOWER & CURRENT AMP

Audio signal from the Genie Bass Keyer passes through these two transistors and is transformed into a low impedance signal. This signal is then routed to the String Bass and Guitar Bass Switchers Q228 & Q229.

Q225 GENIE BASS KILLER

The Genie Bass Killer Q225 has a positive voltage applied to its base from the Pedal 8/16 Keyer Q193 each time a pedal is played. This voltage causes Q225 to turn on which grounds the output of the Genie Bass Emitter Follower Q223, cancelling the Lower Keyboard Genie Bass until the pedal is released. This makes it possible to play the bass pedals at various intervals while the Genie Bass is being used.

GENIE GUITAR & STRING BASS SWITCHING

Turning on the Genie Guitar Bass tab applies positive voltage to Switcher Drivers Q226 & Q227. This turns on FET Switchers Q228 & Q229 allowing audio signal from Q224 to pass to the Guitar Bass Harmonic and String Bass filters. Turning on the Genie String Bass tab or the Magic Chord tab with the Boogie Woogie Bass tab, applies a positive voltage through Switcher Driver Q227 turning on FET Switcher Q229. This allows audio signal to pass to the String Bass Filter IC63A. The audio signal is filtered through IC61C & IC63A then passes to the Pedal Mixing Preamp.

PEDAL 8, PEDAL 16

Audio signal from the 16-foot Pedal Keying is applied to the input of the Diaphone & Pedal 16 FET Switchers Q230 & Q235. Turning on the tabswitches or a general preset using these voices applies a positive voltage through their associated switcher drivers, turning on the FET switchers. This allows audio signal to pass through the FET switchers to the Diaphone & Pedal 16 filtering circuits. After filtering the signal is routed to the input of the Pedal Mixing Preamp IC61D.

Audio signal from the 8-foot Pedal Keying is applied to the input of the Pedal 8 FET Switchers Q233 & Q234. Turning on the Pedal 8 tab or a general preset using this voice applies a positive voltage through Switcher Driver Q232 turning on the FET switchers. This allows audio signal to pass through the FET switchers to the Pedal 8 filtering circuits. After filtering, the signal is routed to the input of the Pedal Mixing Preamp IC61D.

PEDAL WOW

This circuit is a State Variable Filter that acts in conjunction with the .001 capacitors to form an RC low pass filter. Signal from the 8-foot Pedal Keying is gated through the filter at the amplitude of the drive waveform applied to Pins 5 of IC64 and IC65. The output is a low impedance signal that is routed to the Pedal Wow Mixing Preamp IC61D when the Pedal Wow tab is turned on.

IC61D & Q215 PEDAL MIXING PREAMP & EMITTER FOLLOWER

All pedal audio signal (except Pedal String voices) is routed to the Pedal Mixing Preamp. Here the signal is amplified and routed to the base of Emitter Follower Q215. Depending on which of the Pedal Volume Switches is on, the resistance to ground at the output of IC61D is varied regulating the amplitude of the signal applied to the base of Q215. The audio signal applied to Q215 is transformed into a low impedance output signal and routed to the reverb circuit and the Main and Leslie amplifiers.

SCHEMATIC 10

FLUTE AND GENERAL PRESET CONTROL

FLUTE & GENERAL PRESET LATCHES

The Flute and General Preset Latches consist of a switch, inverter and a "D" Flip-Flop. IC67 & IC68 are Hex Schmitt triggers which have a specific threshold voltage. Pressing a preset switch drops the input of the Schmitt triggers below their negative threshold, resulting in a high at its output. As the switch is held in, a phenomenon called switch bounce occurs. The switch bounces and the .1 capacitor charges and discharges, but the voltage never reaches the positive threshold of the Schmitt triggers and its output remains high until the pushbutton is released. (If a normal inverter were used in this circuit, its output would change with each bounce of the switch. This would trigger the clock inputs of the "D" Flip-Flops an indeterminate number of times, making it impossible to determine their end state. When the outputs of the Schmitt triggers go high, they apply a pulse to the clock input of a "D" Flip-Flop. The Flip-Flops are normally in a reset condition - Q low and Q bar high. After clock, both outputs change state and will remain in this condition until 1) the same preset is pressed again applying another pulse to the clock input of its associated "D" Flip-Flop; or 2) pressing a different Flute preset will apply a negative reset pulse (through Diodes D316-D321) to the other two "D" Flip-Flops resetting their outputs, cancelling any Flute preset that was previously on.

Pressing a different General Preset from the one that is currently on applies a negative reset pulse (through Diodes D322 or D323) to the other General Preset "D" Flip-Flop resetting the output, cancelling the General Preset that was previously on.

FLUTE PRESETS

When a Flute preset is active the Q bar output of its associated "D" Flip-Flop goes high turning on a lamp driver which lights the preset switch lamp. This positive Q bar output is also applied to one input of a Flute Preset Driver. If at this time no General Preset is on, the other input to the Flute Preset Drivers will also be high. This enables the driver for the active Flute preset causing its output to go high.

The high level at the output of the Driver is routed through the Preset Module Switches that are in the on position, allowing the selected voices for that preset to play. Also, when a Flute preset is active the Q output of its associated latch goes low. This prevents the positive voltage from the General Preset on Gate IC72D from reaching the base of Buss Driver Enable Q244. This turns off Q244 which causes Q245 to shut off. When Q245 shuts off the positive enable voltage to all the upper keyboard Flute and R/S tabswitches is removed. This disables any voice that may have been on before the Flute Preset was pressed, allowing only the selected Flute preset voices to play.

GENERAL PRESETS

When a General Preset is active, the Q bar output of its associated "D" Flip-Flop goes high, turning on a Lamp Driver which lights the preset switch lamp. At the same time the Q output goes low, causing a General Preset Driver to turn on applying positive voltage through the module switches that are in the on position, allowing the selected voices for that preset to play. Also, the output of the General Preset on Gate IC72D which is normally high, goes low. This causes the following: 1) the Flute Preset Drivers are disabled cancelling any Flute Preset that was previously on; 2) Q245 & Q253 tabswitch buss drivers are turned off by removing the positive voltage from the base of their associated enable transistor. This cancels any upper, lower or pedal voice that was previously on, allowing only the voices selected by the General Preset to play; 3) a low level is applied to Percussion Enable Gate IC76A disabling any percussion voice that was previously on.

When General Preset Driver turns on, it also applies a positive voltage (through D328 or D329) to the R/S switcher enable. This turns on the 4/8 & 16 R/S FET switchers, making audio signal available for any upper R/S voice that may be preset.

GENIE FLUTE ACCENT

Normally, Q254 & Q256 are saturated. Turning on the 2-2/3- or 2-foot Flute tabs at this time applies a positive voltage through Q255 or Q257 allowing these voices to play. To enable the Genie Flute Accent circuit, three conditions must co-exist. 1) The 2-2/3- and 2-foot Flute tabs, or a General Preset containing these voices, must be on; 2) The Genie Flute & Genie Flute Accent tabs must both be on and, 3) The Rhythm must be running. Under the above conditions, the counter outputs from Pin 12 & Pin 13 of IC200 control the state of Q254 & Q256. This causes the 2- and 2-2/3-foot Flute voices to be alternately enabled - creating the Genie Flute Accent effect.

SCHEMATIC 11

REPEAT OSCILLATOR & PERCUSSION CONTROL

PERCUSSION LATCHES

Each Percussion Latch consists of a switch, inverter and a "D" Flip-Flop. IC67 & IC77 are Hex Schmitt Triggers which have a specific threshold voltage. Pressing a preset switch drops the input of the Schmitt triggers below their negative threshold resulting in a high at the output. As the switch is held in, a phenomenon called switch bounce occurs. The switch bounces and the .1 capacitor charges and discharges, but the voltage never reaches the positive threshold of the Schmitt trigger and its output remains high until the pushbutton is released. (If a normal inverter were used in this circuit, its output would change with each bounce of the switch. This would trigger the clock input of the "D" Flip-Flops an indeterminate number of times, making it impossible to determine their end state. When the output of a Schmitt trigger goes high, it applies a pulse to the clock input of a "D" Flip-Flop. These Flip-Flops are normally in a reset condition - Q low and Q bar high. After clock, both outputs change state and will remain in this condition until 1) the same preset is pressed again applying a pulse to the clock input of the "D" Flip-Flop Latch; or 2) in the case of the Carillon, Music Box, Glockenspiel, Celesta and Marimba voices, pressing a different percussion preset from the one that is currently on will apply a negative set pulse to the other "D" Flip-Flops, resetting their outputs and cancelling any of the above-mentioned presets. that were previously on.

When a preset is active, the Q bar output goes high turning on a Lamp Driver transistor which lights the preset lamp. The Q bar output is also applied to various enable gates, turning on the correct footages and control circuits for the chosen voice. With Repeat off, the Phase 1 & 2 lines are held high enabling one input of the 16, 8, 4, 1-3/5 & 1-1/3 Enable Gates. Turning on a voice associated with any of these gates allows positive voltage from the Q bar output of the latch circuit to pass through these gates and enable its associated Flute Encoder output.

PERCUSSION REPEAT

The Repeat Oscillator is a continuous running oscillator. With repeat off, the outputs of the Phase 1 & 2 Keyers IC68C&D are locked in a high state. With repeat on, the outputs of IC68C&D go low until a pulse occurs from the Phase 1 & 2 Drivers IC74C&D. The following description assumes Repeat to be on. Pressing an upper keyboard key creates a positive pulse across the .068 capacitor at the cathode of D445. This pulse performs two functions: 1) it turns on Keydown Reset Transistor Q259, discharging the .12 capacitor and setting the output of IC74A high; 2) the pulse is also inverted through IC68B causing the outputs of both Phase Keyers IC68C&D to go high. This prevents a key from being pressed at the toggle point and assures a consistent pulse length for the initial keydown pulse.

The output of IC74A goes high at keydown causing the output of IC74B to go low. This causes the .12 capacitor to charge through the 330K resistor and the setting of the Repeat Speed Control VR19. As the capacitor charges, it reaches the positive threshold of IC74A causing its output to go low which in turn causes the output of IC74B to go high. The .22 capacitor now discharges through a 68K resistor and Diode D446 until the negative threshold at IC74A is reached and its output again goes high continuing the cycle. The output of the Repeat Oscillator at Pin 8 of IC74B is applied to the clock input of Flip-Flop IC75A. Here two symmetrical waveforms, 180° out of phase at half the oscillator frequency, are produced. These outputs from IC75A are applied to the Phase 1 & 2 Drivers IC74C&D where they are ANDed with the oscillator output. Depending on which Flip-Flop output is high at the time the output of one of the Phase Drivers goes low, which causes a positive pulse to appear at the output of one of the Phase Keyers IC68C&D. The Phase 1 & 2 outputs are applied to the Percussion Enable Gates and provide the Repeat pulses for the Music Box, Glockenspiel, Celesta and Marimba voices. Different components of the above-mentioned voices play on opposite phase alternations; for example, the Marimba voice is a combination of the 8- & 4-foot voices. In the repeat mode the 4-foot component plays on the Phase 2 alternation while the 8-foot component plays on the Phase 1 alternation. The Music Box is a 4-foot voice; in the repeat mode 1-foot is added for the Phase 1 alternation.

The strike tone for the Celesta, Glockenspiel and Music Box voices repeats on both phase alternations. This is accomplished by adding the Phase 1 & 2 outputs through Diodes D454 & D456, allowing IC76A to turn on and off at the frequency of the Repeat Oscillator. IC76A then drives the Percussion Data Enable Gate IC137A, updating the data to the strike tone keying circuit with each repeat pulse. The repeat for the Chiff, Harmonic 4- and 2-2/3-foot voices is also controlled by Driver IC76A since these voices are made up of a single footage.

Turning on the Carillon voice will cancel repeat by holding Pin 12 of IC76A high. With a General Preset on, Pin 13 of IC76A is held low disabling this gate cancelling all Percussion voices.

Q268 & Q269 CHIFF SNUB SWITCHERS

With any percussion preset on, except Chiff, a positive voltage is routed to the base of Q268 turning it on which holds Q269 off. Turning on only the Chiff preset allows the positive collector voltage from Q268 to reach the base of Q269, turning it on which grounds the Chiff Snub line. This gives a short decay time to the Chiff voice.

Q270 & Q271 PERCUSSION SUSTAIN & SNUB REGULATORS

These two transistors are used as emitter followers. The amplitude of the base voltage applied from the preset latches is reflected by their emitters. The more positive this base voltage is, the longer the sustain or Snub time will be.

CIRCUIT DESCRIPTION

SCHEMATICS 12, 13, 14 AND 15

FLUTE ENCODER, DECODERS

The Flute Encoder contains all the logic necessary to develop a keyboard scanning system capable of outputting serial data information for each key on the upper and lower keyboards. Through the use of windowing circuits, gates and data collectors, data for Golden Harp, AOC and Magic Chords is multiplexed onto the key data line along with the keyboard data. Shift registers delay the data as well as apply it via data collectors to the Decoders. The data is shifted through the registers and when aligned with its keyer, is strobed, latching the data to the keyers which cause audio signal to be applied to a filter.

OVERVIEW

The Flute Encoder and Chord Function Generator (CFG) are synchronized. This makes it possible to have a direct data interface between the CFG and the Encoder. The Chord Function Master Oscillator provides all clock inputs to the CFG and the Encoder. The CFG IC183 and the Magic Genie Flute AOC and 4-foot R/S Decoder IC194 are slaved to the Encoder which controls the CFG enable and the decoder strobe for IC194.

The Flute Encoder consists of two cascaded counters. The product of these two counters is a scanning frame with 120 unique time points. The X-Scan develops twelve time points. All like notes have the same X designation. Each T-Scan Time Frame has the width of twelve X time points. The position of the note is determined by its T time frame. Both keyboards are scanned simultaneously from highest note to lowest. Each keydown results in a bit of information occurring at a unique point in time which can be represented by a combination of X time points with T time frames. This data is applied serially (one bit at a time) to shift registers. As the data shifts through the registers, it is delayed in real time before being applied to the data collectors. Each time the data appears at a shift register output line that has a tab pressed, a bit of data is applied to the Decoder. The data continues to shift through the register outputting octave keyer information. This complex serial data is being shifted into serial to parallel decoders. When the data has been shifted to its proper position, a strobe pulse occurs latching the serial data to all outputs. Those outputs with footage information switch high. Each active decoder line turns on one of 85 keyer transistors which in turn, forward biases a diode and applies an audio signal to a filter.

Circuitry is incorporated to repeat the top octave 1-foot pitch at a 2-foot frequency. Similarly, the 1-1/3 and 1-3/5 footages will repeat at a 2-foot pitch for octave frequencies that would normally sound above C9. The low octave 16-foot pitch is not keyed by the decoders. Its pitch is developed by the low octave solo keyer circuitry.

When using multiple footages and playing two or more keys on a manual, two coincident bits of information may be applied to the decoder simultaneously but with different footage information. Because there is only one keyer per octave frequency, no new keydown would be heard. The pantomime circuitry constantly compares data being outputted from the shift registers. When coincident data occurs, a data bit is applied to the Pantomime Decoder where it keys the proper audio frequency which sounds like a new keydown.

The Percussion circuitry develops its frequency data in the same manner as the upper and lower Flutes. In addition, a strike tone is added to give the Glockenspiel, Celesta and Music Box voices a percussive sound at keydown.

The Flute Golden Harp is controlled by the R/S Golden Harp circuitry (Schematic 28). Lower Keyboard AOC information is applied from the R/S Golden Harp enable transistors to Data Collectors where it is sampled and developed into X-Scan data corresponding to the Golden Harp note being played. This Golden Harp data is multiplexed into the key data in one of three time frames to give it a key position and an octave relationship.

The Flute AOC processes keydown data from either the lower keyboard scan or the CFG AOC Decoder (with Magic Chord on) and multiplexes it into the Upper Key Data when an upper keyboard key is pressed. Circuitry is provided to give the upper key a nine-note AOC range to minimize dischords.

The Encoder and Chord Function Generator are synchronized for direct data interfacing. The lower keyboard key data is routed to the CFG to provide information for the High/Low Bass. When the Magic Chord function is enabled, only data corresponding to the Magic Chord keyboard range (A1-G#2) is inputted to the CFG. The CFG outputs the corresponding R/S audio chord and serially encoded chord data to the Magic Genie Flute AOC and 4-foot R/S Decoder IC194. When strobed by the encoder, the outputs of IC194 corresponding to the chord being played go high. The positive voltage is applied to the Magic Chord and Magic Chord AOC Data Collectors where it is sampled by the X-Scan and multiplexed into the lower key data.

CIRCUIT DESCRIPTION

The decoders accept data from the upper, lower and percussion encoding circuits. Serial data is shifted through the decoders. When the data has been shifted into the registers, a strobe latches the data to the outputs. The outputs with active data go positive. The positive voltage turns on a keyer transistor, applying a positive voltage to a keying diode, forward biasing the diode and applying audio to a filter group. The upper decoder incorporates a sustain circuit to give the Upper Keyboard Flutes a controllable sustain which is independent of the Reed/String sustain. The Lower Keyboard Flutes have an independent volume control and a preset sustain which is controlled by the Lower Volume Control.

The Pantomime Decoders shift data from the upper and lower Pantomime Encoding circuitry into the decoders. When the strobe pulse is applied, the data in the decoders is latched to the output pins applying a positive voltage to a keyer diode which turns on and applies audio to the Flute filters.

X-SCAN T-SCAN

The input to the X-Scan Counter IC114A is the Chord Function Master Oscillator Frequency divided by eight (62.5KHz). IC114A is a binary counter that advances with each positive transition of the scan clock. The binary output at Pins 3, 4, 5 and 6 is applied to X-Scan Decoder IC113 where it generates a sequence of twelve square wave pulses which are outputted on the X1 through X12 scan lines. The X-Scan timing points are applied to all circuits with corresponding X designations. The negative edge of the X12 timing point sequentially advances the T-Scan Decoder IC120. An active T-Scan (Time Frame) remains positive for the duration of twelve X-Scan pulses (X1-X12). The result of combining the X and T scans is a serial data stream with 120 distinct timing points. A complete data stream of 120 time points becomes a scanning frame. The keyboard is scanned at the rate of approximately 520.8 frames per second.

The 62.5KHz input frequency is applied to all scan clock inputs of the encoder. The scan clock pulses are inverted by IC121B and applied to all circuits using the inverted scan.

X-SCAN COUNTER RESET

Initially, Pin 8 of IC112A is high which is applied through IC122A, inverted by IC121A and applied as a low to IC114A. At X12, the D input to IC112A goes high. The positive edge of the inverted scan transfers the D input to the output of IC112A which causes Pin 8 of IC112A to go low. The output of OR gate IC122A will go low when the inverted scan goes low. This low is inverted by IC121A and applies a high to IC114A resetting Pins 3, 4, 5 and 6 low which is decoded by IC113 as X1. On the next inverted scan clock pulse, Pin 8 of IC112A switches high until X12 is again high.

UPPER AND LOWER KEYBOARD KEY DATA

Similar notes used in the Encoder have a unique X designation. (All C notes occur at an X1 timing point, B notes occur at an X2 timing point, etc.) Each octave of notes has a Y designation which determines the keyboard position of the notes. The upper and lower keyboards are scanned simultaneously from the highest note to the lowest and occupy the first 61 time points in the scan. When a key is pressed, an X-Scan timing point is connected to a Y line and is applied to an input of a Key Data Collector IC129, IC130 or IC131. When the T-Scan input associated with the Y line is positive, the keydown data (X-Scan) is passed through the internal AND gate, inverted by the internal NOR gate and outputted to the associated upper or lower circuits. **Example:** Pressing an upper C6 key would apply an X1 pulse to the Y1 line. At T1, Pin 1 of IC129 is high allowing the X1 pulse to pass through IC129. This key data bit is now designated T1X1. Pressing a C2 key applies X1 to Y5. At T5, Pin 1 of IC130 is high passing the keydown data to the output of IC129. This key data bit is designated T5X1. Each note of the upper and lower keyboards may be represented by a combination of T and X timing points. The upper keyboard key data is routed through IC139A, IC86A and IC140C to the Upper Keyboard Flute Data Shift Registers. The Percussion Data is routed from the Upper Keyboard Key Data Collectors through IC139C, IC86A, IC138B and IC137A to the Percussion Data Shift Registers. The Lower Keyboard Key Data is routed through IC139E, IC87C, IC89A and IC91A to the Lower Keyboard Flute Data Shift Registers. (See Schematic 13.)

IC86A, IC137A, IC87C, IC91A KEY DATA ENABLES

Key data is applied to the Data Shift Registers through Data Enables and Data Collector circuits. A Data Enable circuit will 1) pass Key Data to the collectors, 2) gate Key Data in short bursts as is the case with the Lower Flute Key Data Enable IC91A or the Percussion Repeat Enable IC137A, or 3) prevent Key Data from reaching the Data Collector. If the Cancel Upper switch is pressed, Pin 9 of IC86A will be low which will lock the output of IC86A low, preventing Keyboard Key Data from reaching the Percussion and Flute Shift Registers.

IC138B , IC140C, IC89A KEY DATA COLLECTORS

The key data collectors multiplex keyboard data with Golden Harp, AOC or Magic Chord key data depending on the gate and functions enabled. The upper key data outputted from Pin 10 of IC140C contains multiplexed key, AOC and Golden Harp Data. The Percussion Key Data Collector IC138B outputs Upper Key Data and Golden Harp Data. IC89A combines Lower Keyboard Data with Magic Chord Data. For discussion purposes, the term Key Data will refer to the multiplexed data outputted from the Key Data Collectors.

DATA SHIFT REGISTERS [IC141 typical]

The purpose of the Shift Registers is to delay the key data in its application to the Flute or Percussion Data Collectors. Each negative transition of the inverted scan clock (positive transition of the non-inverted scan clock for IC84B) shifts the data to the next stage, delaying its output in time points to the Flute or Percussion Data Collectors.

FLUTE, PERCUSSION DATA COLLECTORS [IC135 typical]

Pressing any Flute or Percussion tab causes a positive voltage to be applied to the Enable Input corresponding to the active switch. This high will enable the output of the internal AND gates to follow the data inputted to it from the Shift Registers. The data from the enabled AND gates is collected and inverted by the internal NOR gate and routed to the proper Decoder circuit. The term Flute Data or Percussion Data will refer to the complex multiplexed data containing octave keyer information.

Note: The Upper, Lower and Percussion Data Shift Registers and Data Collectors are identical in operation. For descriptive purposes, the reference numbers for the Upper Keyboard will be used.

For the following example, assume the following conditions: 1) the Cancel Upper pushbutton is off, 2) the AOC, Golden Harp and Magic Chord tabs are off and 3) the following Flute tabs are pressed 2, 5-1/3, 8 and 16-foot. Pressing the Upper Keyboard C6 key results in a key data bit appearing at time point T1X1. This single data bit is applied to the Shift Register IC141 Pin 4. As inverted scan clock pulses are applied to IC141, the data bit will be shifted through the register. After twelve negative transitions of the inverted scan clock, the data bit appears at IC141 Pin 10. Because the 2-foot tab is on, this data bit is applied through IC135 and results in a Flute Data Bit occurring at T2X1. The single data bit is shifted back into the register and continues to be transferred through the register until the next active Flute tab is reached. The data bit has been delayed by 29 time points when it reaches IC133 Pin 9. This high will be applied through IC126 and IC135 and will result in a Flute Data Bit at time point T3X6. The C6 data bit continues to shift through the register. The 8-foot tab will cause a Flute Data Bit to be outputted from IC135 at T4X1 and at T5X1 for the 16-foot Flute tab. By pressing a single key (C6, T1X1) with one bit of keyboard data, the resulting Flute Data has information at T2X1, T3X6, T4X1 and T5X1. This Flute Data is shifted into the Upper Keyboard Flute Decoders IC146, IC147 and IC148 at the rate of the inverted scan clock. At T10X3 the Flute Data has been shifted to its proper position in the Decoders. A negative strobe occurs and the Flute Data is outputted as a positive voltage to the keyer transistors. Keying transistors would activate for the C9, G7, C7 and C6 octave frequencies, applying positive voltage to keying diodes which applies audio signal to the Flute Filters.

FLUTE, PERCUSSION REPEAT ENABLES, REPEAT WINDOWS

The highest pitch of the instrument is a C9 octave frequency. Because the top octave 1, 1-1/3 and 1-3/5 footages would exceed the highest frequency of the organ, circuitry has been incorporated to repeat 1) the top octave of the 1-foot, 2) the top seven notes of the 1-1/3-foot and 3) the top four notes of the 1-3/5-foot.

1-FOOT OCTAVE REPEAT

Assume that only the 1-foot Flute tab is on and the C5 and E5 keys are pressed. Key data bits will appear at time points T1X9 (E5 key) and T2X1 (C5 key). The key data will be applied to IC142A Pin 6 and to IC141 Pin 4 where it will be delayed through the Shift Register. When the T-Scan advances to T2X1: 1) Pin 8 of IC134A goes high and remains in that condition for the duration of the T2 scan, 2) IC135 has outputted Flute data at time points T1X9 and T2X1 which has been shifted into the Decoders and 3) the E5 and C5 key data has been shifted into IC141. As the key data continues to shift through IC141, the E5 data bit appears at IC141 Pin 10. It is applied through IC134A, IC142A and IC135 and enters the Flute Data at time point T2X9. As the C5 key data reaches IC141 Pin 10, the T-Scan advances to T3 which applies IC134A Pin 8 low, preventing the C5 key data from re-entering the Flute Data. The T1X9, T2X1 and T2X9 Flute data bits are shifted through the Decoders. Any Flute data between T1X1 and T1X2 is shifted out of the Decoders because no corresponding pitch is available. When the strobe occurs at T10X3, the T1X9 bit has been rejected, the T2X1 bit keys the C9 octave frequency keyer and the T2X9 bit keys the E8 octave keyer.

1-1/3, 1-3/5-FOOT REPEAT WINDOWS

The 1-1/3 and 1-3/5-foot Repeat Enables function in a manner similar to the 1-foot Flute. Circuitry is required to ensure that the data is reinserted at the proper time points. This is accomplished through the use of window circuits. A window is a set/reset flip-flop that activates and deactivates at specific time points. When the flip-flop is set, a positive voltage is applied to an enable circuit and will keep the gate active until the flip-flop is reset low. The 1-1/3 Repeat is enabled at T2X6 when both inputs to IC103A switch high applying a low to IC95B setting the output high and enabling IC134B to repeat the top seven notes of the 1-1/3 footage. At T2X9, IC108D repeats the top four 1-3/5-foot notes. At T3X1, both windows are reset.

UPPER AND LOWER PANTOMIME COMPARATOR, COLLECTOR AND DECODER

When multiple footages are used, and several keys are pressed, key data for two or more footages may be outputted from the shift registers at a coincident time point and be applied simultaneously to the data collectors. Because there is only one keyer per octave frequency, no new keydown is heard. The Pantomime circuitry constantly compares outputs from the shift registers. When coincident data occurs, a bit is outputted from the Pantomime Data Collector, shifted into the Pantomime Decoder and, when strobed at T9X1, applies a positive voltage to a keyer diode applying audio to the Flute filters giving the sound of a new keydown.

Note: The Lower Pantomime Data is developed in the same manner as described below for the Upper Pantomime Data.

Example: The following Flute footages are active: 4- and 8-foot. The C3 and C5 keys are pressed. Key data appears at time points T2X1 (C5) and T4X1 (C3). The resulting Flute data will have information at T4X1 and T5X1 (C5 key), and at T6X1 and T7X1 (C3 key). If the C4 key is now pressed, Flute data appears at T5X1 and T6X1. Since these Flute data time points are already active for the C5 and C3 keys, no new data enters the Flute Data Collector and a new keydown is not heard. The T5X1 bit for the C5 key is an 8-foot pitch and is applied through IC100C, IC125D and IC125C to Pin 12 of IC143. The T5X1 bit for the C4 key is a 4-foot pitch which is applied through IC108C to Pin 13 of IC143. Because both inputs to the internal AND gate are high, the output goes high and a Pantomime Data Bit appears at T5X1. The T6X1 bit is an 8-foot pitch for C4 and a 4-foot pitch for C3. This information is processed as described above and outputs Pantomime Data at T6X1. The Pantomime Data is shifted into the Pantomime Decoders. At T9X1, the data is strobed and outputted as a high level to the C6 and C5 Pantomime keyer diodes which applies a tone to the Flute filters. This is sensed by the ear as a new key being pressed because of the slight increase in volume.

PERCUSSION, STRIKE TONE

IC137A PERCUSSION, PERCUSSION REPEAT ENABLE

Upper keyboard key data is applied through IC86A and IC138B to Percussion, Percussion Repeat Enable IC137A. With the Repeat tab off, Pin 6 of IC137A is high, passing the data to the Percussion Shift Registers and the Strike Tone Keydown Detector IC137B. With the Repeat tab on, the data is gated through IC137A giving a reiteration effect to the percussion voices.

STRIKE TONE SCAN COMPARE

At time point T1X1, the Strike Tone Scan Compare Enable IC87A is enabled applying scan clock pulses to the 64 Bit Shift Register IC136. At T6X4, IC87A is disabled and any key data shifted into IC136 is stored until the next scan. Percussion Data stored in IC136 is updated with each keyboard scanning frame. As new data is being shifted into IC136, IC137B compares it with the inverted data being shifted out of the register. For IC137B to have an output, both inputs must be high. This can only occur when the new data has keydown information at a timing point different from that of the previous scan frame. A pulse will be outputted to the Recirculating Shift Registers only for the first scan containing new information. Subsequent scan comparisons will have coincident keydown information at Pin 2 and inverted at Pin 1 of IC137B keeping at least one input low. The advantage of this circuit is that if a key is being held and a new key is pressed, only the new key will have a strike tone.

IC128, IC119 & IC127, IC118 STRIKE TONE RECIRCULATING SHIFT REGISTER AND LATCH

Upper Keyboard Percussion Key Data is applied from IC137B through Data Collector IC138D to the input of Recirculating Shift Register IC128. The data will shift through IC128 and IC119 and will be reapplied to IC128 through IC138D. By recirculating the data in this manner, the data looses its time reference. At T6X4, all new keydown data has been

shifted into IC128 and IC119 and is aligned with its keyer. The Strike Tone Scan Compare Window IC110 closes and the data is latched into IC127 and IC118 which applies a high to the respective top octave (C#8-C9) Percussion Keyer. At T10X3, a reset pulse is applied to IC128 and IC119 clearing the shift registers by resetting the Q outputs low.
Note: The strike tone is used only for the Glockenspiel, Celesta and Music Box voices.

IC110 STRIKE TONE SCAN COMPARE WINDOW

IC110 is a set/reset flip-flop. At T1X1, IC110B outputs a low which sets the output of IC110D high enabling IC87A to apply clock pulses to IC136D. IC110C Pin 3 switches low. At T6X4, IC110A applies a low to IC110C which resets IC110D Pin 6 low, disabling the Scan Compare circuitry. IC110C Pin 3 switches high clocking the Strike Tone Latch and the Keydown Detector Latch on the positive transition.

IC93 UPPER KEYBOARD KEYDOWN DETECTOR LATCH

The D input to IC93A is a positive voltage. When any upper keyboard key is pressed, the first key data bit clocks IC93A and transfers the D input to the Q output. At T6X4, IC93B is clocked by the reset of IC110C. The high at the D input of IC93B is transferred to the Q output. This positive voltage is routed to the Keydown Buffer Q13 and activates several circuits (See Schematic 2). At T10X3 the Q output of IC93A is reset low. As long as any keys are held, the Q output of IC93A will remain high. If all keys are released, no clock will occur at IC93A and the Q output will remain low. At T6X4, the output of IC93B will be clocked low.

FLUTE GOLDEN HARP

The Flute Golden Harp processes lower manual Reed/String AOC information into X-Scan serial data. This data is applied to octave select circuitry where the X-Scan data is assigned a T-Scan time frame. When a Golden Harp Octave switcher is active, Harp Key Data corresponding to the time frame is multiplexed into the upper key data and applied to the Data Shift Registers.

IC104, IC105, IC106 GOLDEN HARP DATA COLLECTORS [See Schematic 28].

Positive voltage from the Reed/String AOC drivers is applied to the collectors of Golden Harp Enable Transistors Q583. These transistors are normally saturated which applies this voltage to ground. Pressing the Harp footswitch enables the Harp circuitry which sequentially turns off a Q583 enable transistor, routing the AOC voltage to the Harp Data Collectors IC104-IC106 (See Schematic 12). The AOC voltage is sampled at the rate of the X-Scan. Each active note is serialized into a bit of keydown information with no specific T-Scan time frame. The Harp key data is applied to Enable Gate IC122B.

IC122B, IC132, IC123 GOLDEN HARP DATA ENABLE, OCTAVE SELECT

Pressing a lower keyboard key causes the Golden Harp Enable Switcher to apply a low to Pin 1 of IC122B. The output of IC122B now follows the Harp data applied to Pin 2. The data is applied to three Harp Octave Select Gates IC132A, B &C. IC132A has inputs from the T1 time frame and the high octave switcher. When the Golden Harp is sweeping through the top octave, a positive voltage is applied to IC132A Pin 8. During the T1 time frame, X-Scan data is outputted from IC132A, inverted and multiplexed into the Flute and Percussion key data. Similarly, middle octave data will be outputted in the T2 frame and low octave data will be outputted during T3.
Note: The Golden Harp will continue to function for the Flutes if the Cancel Upper tab is pressed.

MAGIC CHORDS

The Flute Encoder and the Chord Function Generator are synchronized. The CFG Master Oscillator provides the 62.5KHz Scan Clock frequency for the encoder. The CFG IC183 and Magic Genie Decoder IC194 are slaved to the Flute Encoder. Key data from the lower keyboard is inputted to the CFG providing information for both High-Low Bass and Magic Chords. Window circuits route the key data and Magic Chord data to the CFG and the lower keyboard shift registers.

CFG SYNC

The encoder has a scanning frame of 120 time points. The CFG scanning frame has 72 time points. The CFG sync circuitry disables the CFG IC183 for part of the encoder scanning frame. At T5X12, the set/reset flip-flop IC95C&D is set. This applies a positive voltage to Pin 22 of the CFG, disabling the internal functions of the CFG. At T9X12, IC95C&D resets applying a low to the CFG, resetting the CFG to its first time point and enabling the CFG to output its features. The CFG is enabled at a time point that will permit direct data interfacing between the encoder and CFG.

HIGH-LOW BASS

When the Magic Chord tab is off, the enable input to the Magic Chord Key Data Window IC102A&B is low. This locks both outputs of IC102A&B high, enabling both the Lower Key Data Enable IC87C and the CFG Data Enable IC94D to pass Lower Key Data. The CFG is designed to accept only 28 bits of key data (A1-C4). This is processed as High-Low Bass. The CFG selects the highest and lowest bits of key data in the A1-C4 range and outputs this data from the CFG as High-Low Bass.

MAGIC CHORDS

Turning on the Magic Chord tab enables the Magic Chord Key Data Window. Initially, IC102B Pin 10 is low and IC102A Pin 6 is high. This routes Lower Key Data to the Flute Data Shift registers. At T4X4, the window is set rerouting the Key Data to the CFG. This data corresponds with the Magic Chord keys of the lower keyboard. At T5X5 the window closes, resetting IC102B Pin 10 low and IC102A Pin 6 high. The Magic Chord Key Data is decoded by the CFG and is outputted as audio to the lower Diapason filter. The CFG outputs the chord information as serial data which is applied to the Magic Genie Flute AOC and 4-foot R/S Decoder IC194. (See Schematic 19). At T5X11, Magic Chord and Chord AOC Decoder Strobe IC123 applies a pulse to IC194. This outputs a positive voltage at three (Four with the seventh enabled) decoder lines corresponding to the chord being played. This positive voltage is routed to the inputs of IC96, IC97 and IC98 Magic Chord Data Collectors where it is sampled and developed into Magic Chord Data by the X-Scan. The Magic Chord Data is inverted by IC139D and applied to IC87B Pin 6. When the Magic Chord-Chord Data Window, IC88 opens, the Chord Data is multiplexed into the key data and gains a time reference between T3X9 and T4X9 when the window closes.

ENCODER AOC

NON-CHORD MODE
[Magic Genie tab off]

IC140A&B, IC138A NON-CHORD MODE DATA COLLECTORS

Lower keyboard keydown data is combined through OR gates IC140A&B and IC138A into twelve X-Scan designations with no T-Scan time frame. This data is routed to IC137C Pin 13.

IC139C, IC137C, IC138C NON-CHORD MODE DATA ENABLE DATA COLLECTOR

With the Magic Chord tab off, IC137C is enabled. Data from IC138A is applied through IC137C and IC138C and applied to AOC Data Enable IC115A. When IC115A is enabled, AOC data is multiplexed into the upper key data.

MAGIC CHORD MODE

IC96, IC97, IC98 MAGIC CHORD AOC DATA COLLECTORS

Magic Chord information from IC194 is inputted to IC96, IC97 and IC98. This information is sampled by the X-Scan lines and is outputted as X-Scan data to IC139D Pin 11.

IC139D, IC138C INVERTER, AOC DATA COLLECTOR

With the Magic Chord tab pressed, IC137 Non-Chord Mode Data Enable is disabled. Magic Chord AOC data is inverted by IC139D and applied through IC138C to AOC Data Enable IC115A. When IC115A is enabled, AOC data is multiplexed into the upper key data.

AOC 3 BIT DELAY SHIFT REGISTER, WINDOW COUNTER & AOC WINDOW

With each upper keyboard scan, keydown data is applied to the input of IC84A 3-bit Delay Shift Register. After three positive transitions of the scan clock the key data bit will be outputted at IC84A Pin 3. This positive pulse will set the AOC Window and reset the output of AOC 9-bit Window Counter IC114B to zero. IC114B is a binary counter that counts scan clock pulses. When the output of IC114B reaches a binary nine, Pins 11 and 14 are both high which causes the output of IC94A to go low resetting the AOC Window. If several upper keyboard keys are pressed, the window will open three time points after the first bit. IC114B will reset with each key data bit outputted from IC84A and the AOC Window will close nine time points after the last key data bit has reset IC114B. The nine bit counter establishes a fixed range of AOC notes to prevent dischords.

IC115 AOC DATA ENABLE

Pressing the AOC tab applies ground to the cathode of D529. This low is inverted by IC121F and enables IC115A to pass AOC data when the AOC Window is open.

Example; A C chord (CEG) is played on the lower keyboard. This is developed into AOC data with time points X1, X6 and X9 being positive. This AOC data is routed to IC115A Pin 3. Playing an upper keyboard C5 key results in a data bit occurring at T2X1. This key data bit is applied to the window circuitry and the Key Data Collector IC140C. Three time points later (T2X3), the AOC window opens and the AOC data is multiplexed into the upper key data during the T2 time frame. The 9-bit Window Counter resets and begins to count. The window closes at T2X11 preventing any other AOC data from entering the key data. The resulting upper key data applies the following data to the shift registers: 1) the C5 data bit (T2X1) and 2) AOC data at T2X6 and T2X9. The X1 AOC bit does not occur within the nine note range and is not outputted.

SCHEMATIC 14

FLUTE & PERCUSSION DECODERS AND KEYERS

The Flute and Percussion decoders are serial to parallel shift registers. Each register is capable of outputting up to 33 bits of information. The decoders are cascaded. Data from the Flute and Percussion data collectors is shifted through the respective registers by the inverted scan clock. Data occurring during the T1 segment of the scanning frame is shifted out of the decoders because its corresponding pitch is above the highest pitch of the organ. The low octave Flute 16 (C1-B1) is not outputted from the decoders. The low octave 16-foot Flute pitch is developed by the Low-Octave Keying Circuitry (See Schematic 7). At T10X3, IC123A outputs a low pulse which latches the serial data in the decoders to its corresponding output and turns on a Flute keyer. The decoder output will remain positive until the next strobe pulse of IC123A. If the key is still held, the decoder output will remain high.

Q275, Q276, Q277 KEYERS

Positive voltage applied to the base of an NPN keyer transistor turns on the keyer. This applies a positive voltage to the anode of its associated keying diode, forward biasing the diode and applying audio signal to the associated filter group.

Q278, Q279 UPPER FLUTE SUSTAIN REGULATORS

With the Sustain tab off, the base of Q278 is grounded through a 1K resistor. This turns on Q278 applying a positive voltage to Q279 which also turns on. When an upper keyboard Flute key is pressed, capacitor C1 at the base of Q275 is charged. At key release, C1 discharges to ground through Diode D533 and Q279. With sustain on, the bias at the base of Q278 is controlled by VR21. As the voltage at the base of Q278 becomes more positive, its collector voltage becomes less positive. This in turn reduces the bias on Q279 which conducts less. The collector of Q279 now has a positive voltage. Capacitor C1 will discharge through D533 to the reference voltage at Q279. The remaining voltage will discharge onto the base of Q275 giving the sustain effect.

Q283, Q284 LOWER FLUTE VOLUME REGULATORS

The lower Flute Volume Control VR22 controls the bias voltage of Q283. Q283 controls the bias of Q284. The collector of Q284 sets a positive voltage reference at the cathode of D536. When a lower Flute Keyer Q276 is turned on, the voltage at the emitter of Q276 will be applied through D536 until the voltage potential at the anode and cathode is the same. The remaining voltage is applied to the Keyer Diode D537 which will pass an audio signal, proportional to the DC voltage, to the filter groups.

Q280, Q281, Q282 LOWER FLUTE SUSTAIN REGULATORS

Pressing the Sustain Lower Flutes tab gives the lower Flutes a sustain length determined by the voltage divider consisting of the 68K and the 10K resistors. As the Lower Flute Volume Control VR22 becomes more positive, it turns on Q280. This applies a positive voltage to the junction of the 68K and 10K resistors making the junction more positive and effectively lengthening the sustain. With the Sustain Lower Flutes tab off, the discharge path for the .068 capacitors is through D535 and Q282 to ground. With sustain, a positive reference voltage is applied from the collector of Q282 to the cathode of D535. When the .068 capacitor has discharged to this reference, the remaining voltage discharges onto the base of Q276.

PERCUSSION SUSTAIN

When a percussion tab is pressed, percussion data is shifted into the Percussion Decoders. When strobed at T10X3, any data in the registers is latched to the outputs. This positive voltage is applied as a pulse through a C1 capacitor, momentarily keying the Percussion keyer and charging Sustain Capacitor C2. The positive voltage from the Percussion Decoders is applied through D541, reverse biasing D544. If the upper keyboard key is pressed and held, Capacitor C2 will discharge to the reference voltage on the percussion snub line. The remaining voltage will discharge onto the base of Q277. If the upper keyboard key was pressed and released, the voltage at the cathode of D544 is removed. This electrically places the Percussion Sustain Line in parallel with the Percussion Snub line which discharges the sustain capacitor to a lower DC voltage, resulting in a shorter sustain. The Chiff Snub line is used only when the Chiff is used alone and provides quick discharge path for the sustain capacitor.

SCHEMATIC 15

UPPER AND LOWER KEYBOARD PANTOMIME DECODERS

The Pantomime Decoders are 33 bit serial to parallel shift registers arranged in cascade. Data from the Pantomime Data Collectors is shifted through the respective registers by the inverted scan clock. No Pantomime Data is keyed at frequencies above F7. At T9X1, the Pantomime Decoder Strobe IC115C applies a pulse to the Pantomime Decoders, latching the data in the decoder to its corresponding output and applying a positive voltage to the keying diode. Audio signal is then applied to the Flute filters.

Q287, Q288 STROBE DISABLE

The strobe disables prevent the decoders from randomly keying at power on. When the organ is first turned on, the 25uf capacitor appears as a ground to the DC voltage. This causes Q287 and Q288 to conduct, applying 24 volts to the strobe inputs of the decoders. As the 25uf capacitor charges, Q287 and Q288 turn off enabling strobe pulses to reach the strobe inputs of the decoders.

SCHEMATIC 16

UPPER & LOWER FLUTE FILTERS, TREMOLO & CHORUS SWITCHING

Audio signal from the Tone Generators is collected into Flute Keying Groups. Each group consists of a specific range of octave frequencies which is applied to one of fourteen Flute Filters. After filtering, the signal is collected and amplified then routed to the Leslie Volume Regulator, Chorus Mixing Preamp, Reverb and the Main Channel Flute Low-Pass Filter.

FLUTE FILTERS

The Flute Filters are three-pole low-pass filters. The output of each filter is inverted from, and should be approximately half the amplitude of, the input.

IC162C FLUTE COLLECTOR AMP

Filtered audio is applied to IC162C where it is amplified by a gain factor of approximately 4 and applied to the Leslie Volume Regulator IC252, Reverb IC250A, Main Channel Low-Pass Filter IC27C and Flute Chorus Switcher Q293.

IC27C, IC27D MAIN CHANNEL FLUTE LOW-PASS FILTER AND INVERTER

Low frequency Flute audio is allowed to pass through the Flute Low-Pass Filter IC27C. It is inverted by IC27D which has a unity gain factor and applied to the Main Flute Photocell P3. A steady DC voltage is applied from the Flute Lamp Driver Q30 to the lamp keeping the photocell resistance low and passing the low frequency audio to the Reed/String Mixing Preamp IC39A. Placing the Leslie Tremolo Switch to ON allows the Flute Lamp Driver DC voltage to be modulated by the vibrato. This causes the Photocell Lamp to vary in intensity which gates the low frequency audio through P3 creating a tremolo effect for the Low Frequency Main Channel Flutes.

Q292, Q293 FLUTE CHORUS SWITCHER

When the Flute Chorus tab is off, a negative voltage is applied to the gate of Flute Chorus Switcher Q293 pinching it off, preventing audio from reaching the Chorus Mixing Preamp. Turning on the Flute Chorus tab applies a positive voltage to the base of Chorus Amplitude Switcher Q292. This shunts the 100K resistor to ground, reducing the amplitude of the Flute audio to compensate for the amplification accomplished by the Chorus Mixing Preamps and the Phase Amplifiers. The negative voltage is removed from the gate of Q293 allowing it to conduct. This permits the audio signal to pass to the Chorus Mixing Preamp IC28C.

SCHEMATIC 17

FLUTE AND STRING CHORUS MODULATOR

All 3 channels, Phase 1, 2 and 3, of the Chorus Modulator are identical in operation. For discussion purposes the schematic references for Phase 1 are used in the description below.

Q307, Q308 CLOCK 1 AND PULSE SHAPER

Clock 1 Q308 oscillates at a frequency of 19Hz. The output from Clock 1 is applied to the Pulse Shaper Q307 where it is amplified and applied to the input of the high frequency Divide-by-3 network. Here the waveform is divided and appears as three outputs with a 120 degree phase shift between Pins 6 and 4, 4 and 2 and 2 and 6. With the Chorus Celeste switch in the Celeste position, Clock 1 is disabled, and the chorus runs at the speed of the low frequency clock, Clock 2.

Q299, Q300 CLOCK 2 AND PULSE SHAPER

Clock 2 Q299 oscillates at a frequency of 2.2Hz. The output from Clock 2 is applied to the Pulse Shaper Q300 where it is amplified and applied to the input of the low frequency Divide-by-3 network. Here the waveform is divided and appears as three outputs with a 120 degree phase shift between Pins 6 and 4, 4 and 2, and 2 and 6.

Q309, Q310, Q317, Q318, Q325 AND Q326 PHASE 1, 2 AND 3 FILTERS

The similar outputs from the high and low frequency divide-by-3 networks are combined and applied to a low pass filter tuned to approximately 1 Hz. The output from the filter is a low frequency, irregular sine wave which is used as the drive signal for the voltage-controlled oscillator.

IC168, IC170 AND IC172 VOLTAGE-CONTROLLED OSILLATOR

The output of the voltage controlled oscillator is a triangle waveform 2 volts peak-to-peak with an average DC level of 5 volts. The frequency of this waveform is dependent on the amplitude of the drive signal from the filters. Since the drive signal is an irregular waveform, the output frequency of the oscillator is constantly varying. The output from the oscillator is then applied to the phase splitters.

Q311-Q313, Q319-Q321, Q327-Q329 PHASE 1, 2 AND 3 PHASE SPLITTERS

The collector and emitter outputs of Q311 follow the output from the voltage controlled oscillator (the collector output being inverted). When the collector of Q311 is high, Q312 turns on applying a negative pulse to Pin 5 of IC169. When the emitter of Q311 goes high, Q313 turns on applying a negative pulse to Pin 2 of IC169.

IC28B, IC28C, Q297, Q298 VOX CELESTE & PEDAL STRING AMP, CHORUS MIXING PREAMP AND INPUT PREAMPS

Audio signal from the Vox Celeste and Pedal String circuits is combined and amplified by the Vox Celeste and Pedal String Amp IC28B. This audio is then combined with audio signal from the Flute, String and Symphonic Wow circuits by Chorus Mixing Preamp IC28C and applied to the reverb and input preamps. The input preamps amplify this signal which is then routed to the inputs of the Phase 1, 2 and 3 Bucket Brigades.

IC169, IC171 AND IC173 BUCKET BRIGADE

The Bucket Brigades are analog shift registers which sample the input audio signal at the rate of the Clock pulses from the Phase Splitters. Each time a negative clock pulse is applied to Pin 2 and then Pin 5 of IC169, the audio signal is transferred to the next stage of the Bucket Brigade until it appears as output at Pin 6. This causes a delay between the input and output signal. Since the frequency of the clock pulses are constantly varying, the delay time of the signal through the Bucket Brigade also varies, phase modulating the audio. The delay time of Phase 1, 2 and 3 are constantly varying but will never be the same at any one time. The audio signal output from the Bucket Brigade is then applied to the low pass filters.

Q314 & Q315, Q322 & Q323, Q330 & Q331 LOW PASS FILTERS

The low pass filters filter out the high frequency clock component that is contained in the audio signal. The outputs of the Phase 1, 2 and 3 Low Pass Filters are then cross-coupled for amplitude variation before being applied to the output amps.

Q316, Q324 AND Q332 PHASE 1, 2 AND 3 OUTPUT AMPS

The audio signal from the low pass filters is applied to the output amps where it is amplified and routed to the Main, Phase 2 and Phase 3 Power Amplifiers.

SCHEMATIC 18

PERCUSSION FILTERING AND CHORUS

Audio signal from the Tone Generators is collected into Percussion Keying Groups. Each group consists of a specific range of octave frequencies which is applied to one of fifteen Percussion Filters. After filtering, the signal is collected and amplified then routed to Low-Pass filters. One Low-Pass filter applies the percussion audio to a Bucket Brigade where the signal is phase modulated. The second Low-Pass filter combines the normal and phase modulated audio and applies it to the Reed/String Mixing Preamp.

PERCUSSION FILTERS

The Percussion Filters are three-pole low-pass filters. The output of each filter is inverted from, and should be approximately half the amplitude of, the input.

IC176D PERCUSSION CHORUS PREAMP

Filtered audio is applied to IC176D where it is amplified by a gain factor of approximately 2 and applied to Input and Output Low-Pass Filters.

IC180C&D AND Q335 & Q336 CHORUS SPEED AND VOLTAGE CONTROLLED OSCILLATORS

The Chorus Speed Oscillator produces a triangular waveform of about .7 Hz at the output of IC180D.

The Voltage Controlled Oscillator runs at a speed which is inversely proportional to the amplitude of the input from the speed oscillator. Since the amplitude of the input from the speed oscillator is constantly changing, the frequency of the voltage controlled oscillator varies. This in turn varies the delay time of the audio signal through the bucket brigade resulting in a phase modulated signal.

IC180A INPUT LOW-PASS FILTER

The input Low-Pass Filter prevents intermodulation by filtering out certain high frequency signals. The output of this filter is then applied to the input of the bucket brigade.

IC181 BUCKET BRIGADE

The Bucket Brigade is an analog shift register which samples the input audio signal at the rate of the Clock pulses from the Voltage Controlled Oscillator. Each time a negative clock pulse is applied to Pin 2 and then Pin 12 of IC181, the audio signal is transferred to the next stage of the Bucket Brigade until it appears as output at Pin 14. This causes a delay between the input and output signal. Since the frequency of the clock pulses are constantly varying, the delay time of the signal through the Bucket Brigade also varies, phase modulating the audio. The audio signal output from the Bucket Brigade is then applied to the low pass filter.

IC180B OUTPUT LOW-PASS FILTER

The output Low-Pass Filter filters out the high frequency clock component that is contained in the audio signal at the output of the Bucket Brigade. The phase modulated audio is combined with the normal percussion audio by IC180B and applied to the R/S Mixing Preamp IC39A.

PERCUSSION FULL TABSWITCH

When the Percussion Full tab is placed on, the output resistance is decreased which increases the volume of the percussion voices. To prevent the Piano and Diapason voices from increasing in volume, a 47K resistor is placed in series with the Piano and Diapason inputs to change the gain factor from unity to approximately .5.

SCHEMATIC 19

CHORD FUNCTION GENERATOR [CFG]

CHORD FUNCTION GENERATOR IC183

The Chord Function Generator IC183 contains a scanning system, five programmable frequency generators and the required logic to provide four output features which are bass, chord, strum and arpeggio. The scanning system is capable of scanning 72 time points on a sequential basis. The scan matrix is partitioned in a 12 (X scan) by 6 (Y scan) array. Sequential pulses are outputted on the 12 X lines and a particular time point is active when one of the X lines is connected to one of the Y lines. In the non-chord mode (Magic Genie Chord tab off) the bass feature is the only function that is enabled. In this mode of operation bass signal is outputted from Pins 6 & 7 of the CFG. In the chord mode (Magic Genie Chord tab on) circuitry is enabled to add data bits. These bits correspond to the notes in the chord being played. For example, if a chord is being played there will be data bits at 3 of the 72 time points. If the A2 Key (which is the 7th switch) is pressed, a fourth data bit is added to the chord; pressing the minor footswitch shifts the data at one of the time points creating the minor of the chord being played. The minor and 7th of the chord reset with each new keydown. The other features of the chip, strum and arpeggio, can also be enabled when the chip is in the chord mode. All the features are outputted when a key is pressed. If the chord hold tab is turned on, the features latch and will continue to play after the key is released. Turning on a rhythm disconnects Pin 21 of the CFG from Pin 31 of the CFG. This sets up the CFG to accept rhythm pulses for triggering the Boogie Woogie Bass sequence.
Note: The Arpeggio, 7th, Minor, Chord Hold, Magic Chord and Any Rhythm On features of the CFG are inverse functions. This means that the time points for these functions are active when the feature is not playing. To enable these functions to operate, the X and Y lines associated with them must be disconnected.

The CFG is synchronized to the Flute Encoder. Lower Manual Key Data is applied from Pin 3 of IC94D to Pins 19, 20 and 21 of the CFG. This data is then decoded into High/Low Bass or Magic Chords depending on the position of the Magic Chord tab. Because the CFG is capable of scanning only 72 time points, it must be disabled for a portion of the Flute Encoder scan. This is accomplished by the CFG Sync circuit shown on Schematic 13. At timing point T5X12, a high is applied from Pin 6 of IC95C to Pin 22 of the CFG. This disables the CFG until timing point T9X12, when the CFG Sync applies Pin 22 low, resetting the CFG to its first timing point and enabling it to accept Key Data and output its features.

Q353 CHORD FUNCTION MASTER OSCILLATOR
Q353 develops a continual high frequency signal of approximately 500 KHz that is applied to Pin 3 of IC191B & IC193A. With the D input and Q bar output of IC191B tied together, it becomes a divide-by-two divider. It also acts as a buffer stage between the Master Oscillator and the CFG. The divided-by-two clock frequency from IC191B is applied to five programmable frequency generators via Pin 24 of the CFG IC183. The programmable generators are each capable of generating one of 12 frequencies, dependent on the address code provided them. These generators supply the audio signal for the bass in both the chord and non-chord mode of the CFG. The generators also supply the audio signal for the Magic Chords, Strum and Arpeggio features in the chord mode of the CFG. The divided clock frequency from IC191B is also applied to IC192A&B where it is divided-by-two twice and routed to the Flute Encoder Scan Clock and the Clock Input of the Magic Genie AOC and 4-foot Decoder IC194. The signal output from Q353 that is applied to IC193A is divided-by-three by IC193A&B with an output of approximately 166 KHz at Pin 9 of IC193B. This signal is applied to Pin 2 of IC195 and IC196 where it is divided and used for the 4-foot Magic Chord signal.

MAGIC GENIE CHORDS

Turning on the Magic Chord tabswitch performs the following functions: 1) The base of 7th Enabler Q339 is ungrounded allowing positive voltage to reach its base; 2) Positive voltage is routed through Diode D608 to the base of B.W. Bass Enable Q347 when B.W. Bass tab is on; 3) Positive voltage is applied to the base of Q348 Magic Chord tab "on" switcher. This turns on Q348 and disables the Lower Keyboard A1-A2 keyswitch by grounding the keying voltage through Diodes D120-D132.

When Q348 turns on, it also causes Q349 Serial Data Switcher to turn off, allowing the Serial Data from Pin 23 of the CFG to pass to Magic Genie AOC & 4-foot Decoder IC194; 4) Positive voltage is applied to Pin 8 of IC185D Magic Chord Enable locking its output Pin 10, high. This blocks the negative transition of the X line at Pin 29 from the Y line of Pin 21 and puts the CFG in the chord mode of operation and 5) A positive voltage is applied from point RU to IC139 & IC102 Magic Chord Key Data Window Enable. This permits Pins 19, 20 and 21 of IC183 to accept lower manual key data only during time points T4X4 to T5X5. This corresponds to the Magic Chord Keys A1-G#2.

Pressing a Magic Chord keyswitch (A1-G#2) at this time causes data bits to appear at three CFG time points. These data bits provide the address code for the programmable frequency generators, causing three audio frequencies that form a specific chord to be outputted at Pin 5 of the CFG. These audio signals are then applied to the Magic Chord Preamp Q344 where they are amplified and routed to the Lower Keyboard Diapason and Genie Modulator circuits. Magic Chord Squelcher Q346 has positive voltage applied to its base from the Magic Genie AOC Decoder each time a Lower Keyboard key is pressed, turning on Q346 which turns off Q345 and ungrounds the Magic Chord output. With no lower keys held, Q345 grounds the Magic Chord output preventing any leakage that might occur.
Note: In the Magic Chord Mode of Operation, only the highest chord being played will sound.

MAGIC GENIE AOC

With the Magic Chord tab on, holding down a chord keyswitch outputs information on the Serial Data stream (Pin 23 of the CFG) which corresponds to the chord being played. Under these conditions, Serial Data Switcher Q349 is turned off through Magic Chord "On" Switcher Q348, and the Serial Data information passes through Inverter Q350 to the input Pin 3 of the Magic Genie Flute AOC & 4-foot R/S Decoder IC194. The output Pin 6 of IC191B (approximately 250 KHz) is applied to IC192A&B where it is frequency divided by four and routed to the Clock Input Pin 2 of IC194. The Serial Data Information is transferred into IC194 with each clock pulse at Pin 2. At time point T5X11 of the Flute Encoder, a strobe pulse from IC123C applies Pin 37 of IC194 low transferring the AOC information out of IC194. If for instance a C Magic Chord was being held this would result in a positive voltage on the C, E & G lines or Pins 14, 18 & 21 of IC194. This positive voltage is then routed to the AOC drivers. From this point, the AOC operates as described under the Schematic 27 heading. This positive voltage is also routed to the Magic Chord and Magic Chord AOC Data Collectors IC96, IC97 and IC98 where the AOC and Magic Chord Data is processed as described under the Schematic 12 and 13 circuit descriptions.

CIRCUIT DESCRIPTION

MAGIC GENIE 4-FOOT TOS

Audio signal from the Chord Function Master Oscillator is divided-by-three by IC193A&B producing a signal of approximately 166 KHz at Pin 9 of IC193B. This signal is applied to Pin 2 of IC195 & IC196 where it is divided simultaneously producing twelve specific audio frequencies. These frequencies are used for the Lower Keyboard 4-foot voices when the CFG is in the chord mode of operation. Serial data information corresponding to the Magic Chord being held is clocked into Magic Genie Flute AOC and 4-foot R/S Decoder IC194.

At time point T5X11, a strobe pulse from IC123C of the Flute Encoder is applied to IC194 Pin 37. The negative edge of this pulse transfers the chord information out of IC194 which results in a positive voltage at the anodes of three diodes D603. The diodes are forward biased allowing three audio signals that form a specific chord to pass to the lower keyboard 4-foot filtering circuits.

CHORD HOLD ENABLE

With the Chord Hold tab off, Pin 12 of IC185C is held low. This causes the output of IC185C at Pin 11 to follow the X line from Pin 28 of the CFG. This in effect connects the X Scan Line at Pin 28 to the Y Scan Line at Pin 21 and is the condition of the CFG chip when the Chord Hold feature is not operating. Turning on the Chord Hold tabswitch locks the output of IC185C high, disconnecting the X and Y Scan Line which puts the CFG in the Chord Hold Mode. In this mode of operation, all Magic Genie functions will continue to be outputted after all Lower Keyboard keys are released.

7TH ENABLE

With the Magic Chord tab on, positive voltage from Q340 is applied to the base of Q339 turning it on. This connects the X output on Pin 26 of the CFG to the Y line at Pin 21 and activates the 7th time point of the CFG. This is the condition of the CFG when the 7th of the chord is not being played. To enable the 7th to play the above, X and Y lines must be momentarily disconnected. This is accomplished by the following: Pressing the A2 keyswitch applies a positive voltage to the base of Q340, turning it on which removes positive voltage from the base of Q339 and turns it off. When Q339 turns off, the X and Y lines are disconnected, deactivating the 7th time point which adds the 7th component to the Magic Chord being played.

MINOR ENABLE

When the minor of the chord is not being played, Minor Enable Q341 is held on which holds Pin 2 of IC185B low. With Pin 2 of IC185B held low, its output at Pin 3 will follow the X line from Pin 27 of the CFG. This in effect connects the X line at Pin 27 to the Y line at Pin 21 and is the condition of the CFG when the minor is not being played. To enable the minor to play the above X and Y lines must be momentarily disconnected. This is accomplished by the following: activating the minor switch (located to the right on the expression shoe) lowers the voltage on the base of Q341 turning it off. This causes Pin 2 of IC185B to go high, which in turn locks its output Pin 3 high. With Pin 3 held high, the negative transition of the X line at Pin 27 of the CFG is not passed to the Y line at Pin 21. This deactivates the CFG time point for the minor, changing the Magic Genie chord being played to a Minor chord.

STRUM

STRUM ENABLE

Holding a chord keyswitch with the Magic Chord tabswitch on, outputs the frequencies of the chord being played on the four strum signal lines Pin 1, 2, 3 & 40. If the Ukulele tab is on, the X line at Pin 32 of the CFG is connected through the Ukulele Strum Enable Gate IC184C to the Y line at Pin 21 and the frequencies outputted on the signal lines will be one octave higher. Each time a pulse occurs at Pin 15 of the CFG from the Strum Trigger Q358, a sequence of keyer pulses are generated and outputted on the four Strum Keying Lines, Pins 8, 9, 10 & 11. The frequency of this sequence of keyer pulses is determined by the RC network on Pin 14 of the CFG. The first keyer pulse appears on the Root Keying Line, then the 3rd, 5th and 7th. If the 7th of the chord is not enabled (see 7th Enable), the sequence will not include a pulse on Pin 8 for the Strum 7th signal. The pulses on the four keying lines are applied to the anodes of Diodes D589, D592, D595 & D598 turning them on, allowing audio signal on the four strum signal lines to pass to the Strum Preamp Q343. Here the signal is amplified and routed via either the Guitar or Ukulele Strum tabs to various voicing circuits.

STRUM TRIGGER

Turning on the Swing, Dixie, Shuffle, Swing Waltz, Waltz or Swing March rhythm switch applies a positive voltage to the base of Q359, turning it on. This lowers the voltage on the base of Q360 which turns off. When Q360 turns off it applies a positive voltage to Pin 1 of Strum Trigger Gate IC188B. With Pin 1 of IC188B held high, it acts as an inverter and its output at Pin 3 will be the inverted input applied to Pin 2. The input at Pin 2 can come from the ROM IC201 Pin 22 or Pin 23 or from the Boogie Bass Trigger gates, depending on the position of the Strum/Upbeat/Downbeat tab and the Boogie Bass tab. The output of IC188C can be considered high, so when Pin 3 of IC188B goes high a negative pulse results at Pin 8 of IC188D, momentarily lowering the voltage on the base of Q358 turning it off. When Q358 turns off, its collector applies a positive pulse to Pin 15 of the CFG IC183 triggering the strum sequence. For the above-mentioned rhythms, the strum sequence will occur with the Accompaniment pulse when the Strum tab in the Upbeat position, and with the bass pulse in the Downbeat position (Boogie or High/Low Bass, depending on the position of the Boogie Bass tab). Using any rhythm except the above-mentioned causes the following: Q359 is off, which applies a positive voltage to the base of Q360. This turns Q360 on, holding Pin 1 of IC188B in a low state. With Pin 1 of IC188B held low, its input at Pin 2 has no effect and its output at Pin 3 is locked high. The high output from Pin 3 is applied to Pin 4 and 10 of IC188 causing these gates to act as inverters. The Trigger Pulse at the output of IC188D will follow the negative transition of the counter output from IC200 Pin 12. Putting the Strum tab in the downbeat position inverts the output from Pin 12 through IC188A. The trigger output at Pin 8 of IC188D will now follow the positive transition of the counter output from Pin 12. For the specific time point where the strum sequence occurs for each rhythm, see the Rhythm Patterns Diagram in the Chart Section of this manual.

ARPEGGIO

ARPEGGIO ENABLE

Turning on the Piano or Harpsichord Arpeggio tab applies a positive voltage to Pin 6 of IC185A Arpeggio Enable, locking its output at Pin 4 high. This blocks the X line at Pin 25 of the CFG from the Y line at Pin 21 and enables the internal CFG Arpeggio Shift Register. Pulses are applied to the shift register from one side of the internal Arpeggio Clock Oscillator. The shift register advances with every other transition of the clock and generates a keying pulse which appears on Pin 13 of the CFG. The clock is triggered from the Arpeggio triggers through Pin 12 of the CFG. The shift register also addresses a multiplexer which has as its input 3 octaves of root, 3rd and 5th frequencies of the Magic Chord being played. The output of the multiplexer passes through some gating and appears on the arpeggio signal line, Pin 39 of the CFG. A different frequency is outputted on Pin 39 each time the shift register advances. When the keyer pulse is present on Pin 13, D586 is turned on allowing the audio signal on Pin 39 to pass to the Arpeggio Preamp Q342. Here the signal is amplified and routed through the Piano or Harpsichord tab to the Piano filter or Harpsichord Preamp.

ARPEGGIO TRIGGER

Turning on the Swing, Dixie, Shuffle, Swing Waltz, Waltz or Swing March rhythm switch applies a positive voltage to the base of Gate Selector Q359, turning on Q359 which in turn switches Q360 off. With Q359 on, Pin 12 of IC187B is held low, disabling this gate. With Q360 off, Pin 8 of IC187A is held high, causing this gate to act as an inverter. The input at Pin 9 of IC187A is the delayed strobe pulse. When the positive strobe pulse occurs, Pin 10 of IC187A goes low applying an arpeggio trigger pulse to Pin 12 of the CFG. If a rhythm is being used that is not mentioned above, IC187A will be disabled and IC187B will act as an inverter due to the condition of Q359 & Q360 and the off condition of the above-mentioned rhythms. The input on Pin 13 of IC187B is the delayed strobe pulse which has been frequency divided-by-two through Gate IC186A. When the strobe pulse occurs, Pin 11 of IC187B goes low applying an arpeggio trigger pulse to Pin 12 of the CFG. Because of the nature of the Arpeggio Clock (see Arpeggio Enable), the frequency of the keyer pulse at Pin 13 of the CFG will be half that of the frequency of the trigger pulse applied to Pin 12.

HIGH/LOW BASS

With the Magic Genie Chord tabswitch off, the only feature of the CFG chip that is outputted is the High/Low Bass. In this mode of operation, holding down two or more lower keyboard keyswitches (A1-C4) causes the following: Audio signal corresponding to the lowest note being played is outputted from Pin 7 of the CFG and the highest note is outputted from Pin 6. These signals are routed through High/Low bass select circuits to the base of Q221 Divider Driver (see Schematic 9). With no rhythm on, positive voltage from the Rhythm Start tabs is applied to the select circuits allowing only low bass signal to pass to Q221.

ROOT/FIFTH BASS

With the Magic Genie Chord tabswitch on, the bass feature of the chip is in the Root/Fifth mode of operation. If a Magic Genie Chord (one-note chord) is held at this time, the audio signals at the bass root output (Pin 7) and bass 5th output (Pin 6) are the root and 5th components of the chord being played. These signals are routed through High/Low bass select circuits to the base of Q221 Divider Driver (see Schematic 9). With no rhythm on, positive voltage from the rhythm start tabs is applied to the select circuits allowing only the root bass signal to pass to Q221.

BOOGIE WOOGIE BASS

BOOGIE WOOGIE BASS ENABLE

Turning on the Boogie Woogie Bass tab with the Magic Chord tab on, allows positive voltage to pass through Diode D609 to the Low Bass Selectors Q218 & Q219 and also through Diode D608 to the base of Q347. The voltage applied to the bass selectors holds the signal path for the Low Bass signal on. (In the Boogie Woogie Bass mode, audio signal is only outputted from Pin 7 of the CFG.) The voltage applied to the base of Q347 turns Q347 on. This holds Pin 6 of IC184B low and also resets the Boogie Woogie Bass shift register through Pin 6 of the CFG. With Pin 6 of IC184B held low, its output at Pin 4 follows the X Scan Line from Pin 30 of the CFG. This puts the CFG bass feature in the Boogie Woogie mode.

Under the above conditions with a rhythm on (see Any Rhythm On Gate IC184D), 5 signals are multiplexed to the bass Low/Root output, Pin 7 of the CFG. The multiplexer is controlled by a shift register. Each time a trigger pulse is applied to Pin 37 of the CFG from the Boogie Bass Triggers, the shift register advances one position and outputs the next signal in the bass sequence. The signal is outputted at Pin 7 of the CFG, then routed through the Low Bass Selectors to the base of Divider Driver Q221. If a keydown occurs before the bass sequence is complete, the shift register will reset to the starting point.

BOOGIE WOOGIE BASS TRIGGER

Turning on the Swing, Dixie, Shuffle, Swing Waltz, Waltz or Swing March rhythm switch applies a positive voltage to the base of Gate Selector Q359. This causes Q359 to turn on which in turn causes Q360 to turn off. With Q359 on, Pin 5 of IC187D is held low, disabling this gate. With Q360 on, Pin 1 of IC187C is held high causing this gate to act as an inverter. The input at Pin 2 of IC187C originates at Pin 11 of IC189A. The output from the clock multivibrator is applied to Pin 11 of IC189A where it is frequency divided-by-two; output is applied as input to IC189B. IC189B, 190A & 190B comprise a divide-by-three divider with the output at Pin 5 of IC190B. The input at Pin 1 of IC186B is the strobe pulse. This causes the output at Pin 3 of IC186B to have a pulse width equal to the strobe pulse and a frequency which is the Counter input frequency (Pin 7 IC200) divided-by-three. When Pin 3 of IC186B goes high, a negative pulse results at the output Pin 3 of IC187C (since IC187C acts as an inverter) lowering the voltage on the base of Q357 and turning it off. This applies a positive Boogie Woogie advance pulse to Pin 37 of the CFG. Q356 holds Q357 off momentarily which increases the pulse width of the trigger pulse. At the end of the rhythm measure a negative reset pulse is applied to the Boogie Bass Pulse Dividers, setting the output Pin 5 of IC190B high.

If any but the above rhythms are on, Gate IC187C will be disabled and IC187D will act as an inverter due to the state of Q359 & Q360 and the off condition of the above-mentioned rhythms. The input at Pin 6 of IC187D originates at Pins 12 & 13 of IC186D. The input at Pin 12 of IC186D is the counter input frequency (Pin 10 of IC200) divided-by-two and the input at Pin 13 is the counter input frequency divided -by-four. This causes the output at Pin 11 to be the frequency of the Pin 13 input, having a pulse width equal to the Pin 12 input. This output is then applied to Pin 9 of Gate IC186C, the input at Pin 8 of IC186C is the strobe pulse, the output at Pin 10 will be the strobe pulse at the divided-by-four counter input frequency. When Pin 10 of IC186C goes high, a negative pulse results at the output Pin 4 of IC187D (since IC187D acts as an inverter). This pulse is applied to the base of Q357 which operates as described above. The output from Pin 9 of IC189A also drives the Golden Harp when a rhythm and rhythm sync switch are on.

Q351 RHYTHM & INTRO ON SWITCHER

With no rhythms on, positive voltage from the anode of D631 (see Drawing 20) is applied to the base of Q351 holding it on. Switching on a rhythm lowers the voltage on the base of Q351 through Rhythm Start Transistor Q85. This causes Q351 to turn off applying a positive voltage to the Any Rhythm On Gate IC184D, the Rhythm On Vibrato Killer Q352 and the Strum Trigger Disable Q355. Q351 also performs two functions related to the Golden Harp: 1) Each time the rhythm switches off, a negative reset pulse is applied to Pin 13 of IC189A through D617. This sets the Q output low, and 2) Q351 grounds the "on" of a rhythm sync switch contact. This makes it possible for the Golden Harp to operate from the Harp speed oscillator if the sync switch happens to be on without a rhythm on. With the rhythm off, the base of Genie Accompaniment Switcher Q106 is held low turning off Q106 and applying a steady DC to the Accompaniment Modulator. (See Schematic 6.)

Pressing the Intro switch applies positive voltage to three CFG circuits: 1) through Diode D615 to the base of Q351. This turns Q351 on, disabling the Strum Trigger; 2) through Diode D616 to Pin 13 of IC189A. This prevents IC189A from becoming disabled when Q351 turns on for Intro, and 3) through Diode D620 to the bases of Q359 & Q360, turning them on, disabling the Arpeggio and Boogie Bass Trigger Gates.

IC184D ANY-RHYTHM-ON GATE

With no rhythm on, Pin 2 of IC184D is held low by the on condition of Q351. This allows the X Scan output from Pin 31 of the CFG to pass to the Y Scan Line at Pin 21. Under this condition the internal Boogie Woogie Bass multiplexer is locked in the root position and outputs the Low/Root note from Pin 7 of the CFG. With a rhythm on, the collector of Q351 goes high disabling IC184D blocking the X Scan output from the Y scan. This tells the multiplexer a rhythm has been switched on allowing it to advance with each Boogie Bass Trigger pulse applied to Pin 37.

Q352 RHYTHM ON VIBRATO KILLER

With a rhythm on, the collector of Q351 Rhythm and Intro On Switcher goes positive. This positive voltage is applied to the base of Q352 turning it on. When Q352 turns on, it grounds the output from the vibrato oscillator preventing it from reaching the Chord Function Master Oscillator Q353. This cancels the vibrato effect on the Magic Genie features when a rhythm is on.

Q355 STRUM TRIGGER DISABLE

Pressing the Intro tab turns on Q351 Rhythm and Intro On Switcher, which removes positive voltage from the base of Q355 turning it off. When Q355 turns off, it removes the voltage at the collector of the Strum Trigger Q358 disabling Q358, cancelling Strum for the duration of the Intro Set.

IC191A BOOGIE INTRO RESET

After the Intro Set there is a one clock pulse-delay before the rhythm restarts. The Boogie Intro Reset blocks this pulse from Triggering the Boogie Bass Trigger so the rhythm and bass sequence start together on the second clock pulse after Intro. This is accomplished by the following: Pushing the Intro tab turns on Q351. This puts a low on Pin 13 of IC191A which locks the output Pin 8 high. When the first clock pulse occurs after Intro, the output of the Boogie Trigger Gates will go low but the Boogie Bass Trigger Q357 does not feel this negative transition because Pin 8 of IC191A is still held in a high state. When the output of the Boogie Bass Trigger Gate is making a positive transition IC191A clocks and the Q output from Pin 8 locks in a low state. On the next clock pulse, the Boogie Bass Trigger Gate goes low and is now able to turn on Q357 and trigger the Bass Advance input of the CFG.

SCHEMATIC 20 & 21

AUTOMATIC RHYTHM

The Clock Multivibrator oscillates, producing a square wave output at the collector of Q365. This output is applied to the strobe delay transistor and through Divide-by-two D Flip-Flop IC189A to the Resetable Counter. The Resetable Counter divides the input from IC189A by two, between Pins 10 & 11, 11 & 12, 12 & 13 and 13 & 14. The combined outputs of Pins 10-14 are applied to Brush Decoder circuits, which determine the brush length of some rhythms and also to Pins 35-39 of the Read Only Memory (ROM). Within the ROM, the combined inputs from the counter are decoded which results in a positive voltage appearing on one of the 32 internal decoder lines. As the combined inputs from the counter change, this positive voltage shifts in succession from the 1st through the 32nd decoder line, giving 32 possible rhythm timing points. (In the case of triplet or waltz rhythms, the counter is reset before counting through 32 points.) The Decoder Lines then connect through gating circuits to matrix circuits.

Turning on a Rhythm Selector switch connects the strobe pulse to the ROM. The strobe pulse enables the gating circuit for the rhythm chosen. This allows the voltage on the decoder line, that is positive at this time, to pass through the matrix where it is inverted and routed out of the ROM to the correct instrumentation circuit for that timing point and rhythm. The instrumentation circuits produce the rhythm voice which is then amplified and applied to the rhythm output amp.

RHYTHM CLOCK

[Schematic 20]

Q363 MULTI-STARTER

Pressing the start tabswitch (or pressing a lower keyboard key with the Rhythm Start tab in the auto position) lowers the voltage on the base of the multi-starter Q363. Lowering the voltage at this point performs two functions: 1) A pulse is created across the.05 capacitors applying a negative pulse to Pins 3, 5 and 6 of the Resetable Counter, thereby resetting the counter to timing point 1 (Pins 10-14 will be positive at this time) and 2) Multi-Starter Q363 turns on, supplying voltage to the Clock Multi-Vibrator Transistor Q365, enabling the clock to run.

Q365, Q366 CLOCK MULTI-VIBRATOR

A positive voltage from the Multi-Starter is applied to the Clock Multi-vibrator which enables it to run. The Clock runs continuously producing a square wave output at the collector of Q365. The positive edge of this output triggers the Boogie Bass Pulse Dividers IC189A and the resetable counter and the negative edge triggers the strobe delay transistor. The tempo at which the clock runs is controlled by the rhythm tempo control and various slow down circuits.

RHYTHM STROBE PULSE

The rhythm strobe pulse is developed at the collector of the Rhythm Strobe Keyer Q397. Selecting a rhythm connects this pulse to the ROM where it enables the 32 ROM decoder lines, allowing them to trigger the instrumentation circuits. The strobe pulse is slightly delayed in relation to the ROM decoder outputs. This allows the decoder functions to stabilize before the strobe pulse enables their output.

Q393, IC186A & Q354 STROBE DELAY, GATE & DRIVER

When the output of Clock Transistor Q365 is low, a negative pulse is created across the .01 capacitor at the base of Q293. This lowers the voltage on the base of Q293 turning it off, creating an output pulse at its collector that is one clock pulse delayed. This pulse is then routed to Pin 6 of Strobe Gate IC186A (shown on Drawing 19). The other input to IC186A on Pin 5 is the divided-by-two clock frequency. The output of IC186A will be the pulse width of the strobe pulse at the frequency of the divide-by-two clock. When the output of IC186A is high, Q354 is turned on momentarily lowering the base voltage of the Strobe Keyer (Q392, 395 or 397) that is in operation at the time.

Q397 RHYTHM STROBE KEYER

With the Intro off, the emitter and base of Q397 are positive. When Q354 conducts, it momentarily lowers the base voltage on Q397 causing it to turn on. This develops a positive output pulse at the collector of Q397. Turning on a rhythm selector switch connects this pulse to the ROM input for the rhythm selected. This pulse is routed to the gating circuit for that rhythm and allows the output from the ROM decoder to pass to the rhythm matrix, where the instrumentation circuits for that timing point are selected.

IC200 RESETABLE COUNTER

The Resetable Counter is a five-stage divide-by-two divider, the output of each stage connected to the input of the next. The 1st through 5th divider outputs are Pin 10 through 14, respectively. Applying a negative pulse to Pins 3, 5 and 6 resets the counter to timing point 1 (at this time all five outputs are positive). The five outputs are applied as input to the ROM and are also used to trigger the reset, brush decoder, strum, boogie bass and Flute Accent circuits.

IC201 READ ONLY MEMORY [ROM]

The five inputs from the Resetable Counter are applied to the ROM. These inputs are decoded which results in a positive voltage appearing on one of the 32 internal decoder lines. There is a separate matrix for each rhythm pattern and each matrix has a gating circuit between it and the 32 decoder lines. Turning on a rhythm switch connects the strobe pulse to the gating circuit for the rhythm selected. The strobe pulse enables the gating circuit and allows the voltage on the positive decoder line to pass to the matrix. Here the voltage is inverted and routed to the instrumentation circuits for that timing point and rhythm. As the inputs to the ROM change, the positive voltage counts down the 32 decoder lines one at a time and each time it is pulsed through the matrix by the strobe pulse. This creates the 32 timing points for the rhythm.

Q367 RESET INVERTER

The Reset Inverter has positive voltage pulses applied to its base from the Waltz Reset Line, the Intro End Rhythm Reset Line, the Intro Resetable Counter Reset Line and the Intro Hold Reset. Each time a positive pulse is applied to the base of Q367, it conducts creating a pulse across the .01 capacitors at the anodes of D632 and D633. This momentarily removes the positive voltage on Pins 3, 5 and 6 of the Counter IC200, which resets the counter to the first rhythm timing point. At this time Pins 10-14 are positive.

TRIPLET TIMING

The Ballad, Swing March, Dixie, Swing and Shuffle rhythms are triplet timing rhythms. This means that they only use 24 of the available 32 rhythm timing points. The purpose of the triplet circuitry is to reset the counter to the first timing point after 24 timing points and also to slow down the clock multi-vibrator.

Q381, Q382 TRIPLET, CLOCK SLOW DOWN SWITCHER & RESET ENABLE, TRIPLE RESET

Turning on the Ballad, Swing March, Dixie, Swing or Shuffle rhythm selector switch applies a ground to the Triplet Enable Line. This lowers the voltage on the base of Q381, turning it on. When Q381 turns on, it applies a positive voltage to two places: 1) Through Diode D647 and a 10K resistor to the clock slow down line and 2) Through Diode D648 to the collector of Q382. Q382 is normally held on by a positive voltage through Diodes D649, D650 or D651. When the 24th timing pulse is reached, the outputs of the counter which are connected to these diodes will all be low. This causes Q382 to turn off, allowing its collector to go positive. On the next clock pulse a positive voltage is applied to the base of Q382 turning it on. This creates a negative pulse on Pins 5 and 6 of the counter and resets all the counter outputs to positive or back to the first timing point.

Q379 SWING MARCH, CLOCK SLOW DOWN SWITCHER

Turning on the Swing March, triplet rhythm applies a ground to the Swing March slow down line. This lowers the voltage on Q379, causing it to turn on. When Q379 turns on, it applies a positive voltage to the clock slow down line. This voltage is higher than the voltage applied to the clock from Q381 and causes the clock to run slower for the Swing March rhythm.

WALTZ TIMING

The Waltz and Swing Waltz rhythms are three quarter time rhythms. This means that they only use 18 of the available 32 rhythm timing points. The purpose of the waltz circuitry is to reset the counter to the first timing point after 18 timing points and also to slow down the clock multi-vibrator.

Q384, Q385 WALTZ CLOCK SLOW DOWN SWITCHER & RESET ENABLE, WALTZ RESET

Turning on the Waltz or Swing Waltz rhythm selector switches applies a ground to the Waltz enable line. This lowers the voltage on the base of Q384, turning it on. When Q384 turns on, it applies a positive voltage to two places: 1) Through Diode D653 and a 10K resistor to the clock slow down line and 2) Through Diode D654 to the collector of Q385. Q385 is normally held on by a positive voltage through Diode D656 or D657. When the 18th timing pulse is reached, the outputs of the counter that are connected to these diodes will all be low. This turns Q385 off, allowing its collector to go positive. This positive voltage is applied as a pulse to the base of the Reset Inverter, turning it on which applies a negative pulse to Pins 3, 5 and 6 of the counter. This resets all the counter outputs to positive or back to the first timing point.

BRUSH LENGTH CONTROL
[See Brush Keying]

The length of the brush voice for each rhythm (except for the Waltz, Swing March, Swing and Rock I rhythms, which do not use the brush voice) is regulated by varying the discharge rate of the 8 uf capacitor at the emitter of the Brush Keyer Q430. Turning on one of these rhythm selector switches connects a resistor to ground from the "on" of the selector switch to the Brush Length Control Line. The value of the resistance regulates the discharge rate of the 8 uf capacitor, thereby regulating the length of the brush voice. The length of the brush voice for some of these rhythms varies at different timing points. Turning on one of these rhythms enables a decoder circuit, which will allow a positive voltage to reach the base of the Brush Length Regulator Q373 at certain timing points. These pulses turn on the Brush Length Regulator adding a 5.6K resistor to ground to the brush length control line. This causes the 8 uf capacitor to discharge faster, giving a shorter brush voice for the timing point when Q373 is on.

Note: The 5.6K resistor added to ground by the Brush Length Regulator parallels the resistance to ground from the "on" of the rhythm selected. This means there is less resistance to ground when Q373 is turned on, causing the 8 uf capacitor to discharge faster.

Q369, Q370 & Q372 ROCK II & ROCK III BRUSH DECODER ENABLERS & BRUSH DECODER

Turning on the Rock II or III Rhythm Selector Switches 1) connects a 15K resistor to ground through Diodes D688 or D689 and, 2) applies a positive voltage through Diodes D683 or D684 to the base of Q370. This positive voltage turns on Q370 removing positive voltage from the base of Q369 which now turns off and ungrounds the outputs of Diodes D640 and D641. Each time Pin 12 of the Counter IC200 goes high, a positive voltage will be applied through D639 to the base of Q373. Positive voltage will only be applied to the base of Q373 from D640 when Pin 13 of IC200 is high and Pin 11 is low. When Pin 11 is low, the Rock II and III Brush Decoder Q372 turns off and allows any positive voltage on Pin 13 to pass through D640 to the base of Q373. Positive voltage applied through D640 or D641 to the base of Q373 turns Q373 on which connects a 5.6K resistor in parallel with the 15K resistor to ground from the Brush Length Control Line. This causes the 8 uf capacitor at the emitter of the Brush Keyer Q430 to discharge faster giving a shorter brush length at the timing points when Q373 is on.

Q371 SAMBA, BOSA NOVA & LATIN ROCK BRUSH DECODER

Turning on the Samba, Bosa Nova or Latin Rock rhythm selector switches connects a 15K resistor to ground from the Brush Length Control Line and also allows positive voltage to pass through Diode D685, D686 or D687 to the collector of Q371. If Pin 12 of the Counter IC200 is low, Q371 is off and this positive voltage will pass through D637 to the base of Q373. If Pin 12 of IC200 is high, Q371 will turn on and ground the path through D637 to the base of Q373. Positive voltage applied through D637 to the base of Q373 turns Q373 on which connects a 5.6K resistor in parallel with the 15K resistor to ground from the Brush Length Control Line. This causes the 8 uf capacitor, at the emitter of the Brush Keyer Q430, to discharge faster giving a shorter brush length at the timing points when Q373 is on.

Q374 MARCH POLKA BRUSH DECODER

Turning on the March Polka Rhythm Selector Switch connects a 33K resistor to ground from the Brush Length Control Line and also allows positive voltage to pass through to the collector of Q374. If Pin 25 of the ROM IC201 is low, Q374 will be off and this positive voltage will pass through D638 to the base of Q373. If Pin 25 of IC201 is high, Q374 will turn on and ground the path through D638 to the base of Q373. Positive voltage applied through D638 to the base of Q373 turns Q373 on which connects a 5.6K resistor in parallel with the 33K resistor to ground from the Brush Length Control Line. This causes the 8 uf capacitor, at the emitter of the Brush Keyer Q430, to discharge faster giving a shorter brush length at the timing points when Q373 is on.

Q373 BRUSH LENGTH REGULATOR

This transistor is only enabled when a rhythm having more than one brush length is on. It is turned on from several decoder circuits depending on the rhythm selected. When Q373 turns on, it connects a 5.6K resistor to ground from the Brush Length Control Line. This shortens the discharge time of the 8 uf capacitor at the emitter of the Brush Keyer Q430, thereby creating a shorter brush length.

CYMBAL LENGTH CONTROL
[See Cymbal Keying]

The rhythms using the Cymbal voice are Ballad, Swing March, Waltz, Rock I, II and III, Samba, Swing, Dixie and Bosa Nova. The length of the Cymbal voice for these rhythms is regulated by varying the discharge rate of the 8 uf capacitor at the emitter of the Cymbal Keyer Q426. Turning on one of these rhythm selector switches, except Waltz, Dixie or Swing connects a resistor to ground from the on of the selector switch to the Cymbal length control line. The value of resistance regulates the discharge rate of the 8 uf capacitor thereby regulating the length of the Cymbal voice. (The Waltz rhythm has a long Cymbal voice and no resistor is connected to ground from the Cymbal length control line when this rhythm is turned on). The length of the Cymbal voice for Dixie and Swing is regulated by the Dixie and Swing Cymbal length regulator. Turning on one of these rhythms enables the Dixie and Swing Cymbal decoder which will allow a positive voltage to reach the base of the Cymbal Length Regulator Q376, connecting a 5.6K resistor to ground from the Cymbal Length Control Line. This causes the 8 uf capacitor to discharge faster giving a shorter Cymbal voice for the timing point when Q376 is on.

Q375, Q376 DIXIE, SWING CYMBAL DECODER & LENGTH REGULATOR

Turning on the Dixie or Swing rhythm allows positive voltage to pass through Diode D618 or D619 (shown on Drawing 19) to the collector of Q375. If Pin 25 of the ROM IC201 is low, this positive voltage passes to the base of Q376 and turns it on. When Q376 turns on, it connects a 5.6K resistor from the Cymbal length control line to ground. This causes the 8 uf capacitor at the emitter of the Cymbal Keyer Q426 to discharge faster, thereby giving a shorter Cymbal length when Q376 is on. When Pin 25 of IC201 is high, Q375 turns on and grounds the base of Q376, turning it off.

Q377, Q378 MODULATOR KEYER & DRIVER

Turning on the rhythm allows Q377 to be turned on by negative pulses from Pin 23 of IC201. When Pin 23 of IC201 goes low, Q377 conducts and charges the .27 capacitor at the base of Q378. When Q377 turns off, this capacitor discharges onto the base of Q378 and turns it on. This applies a positive voltage pulse to Pin 5 of IC50 and gates the input signal through IC50 for the duration of the discharge time. The discharge time of the .27 capacitor is controlled by the state of IC200 Pin 25. If Pin 25 is high, the .27 capacitor will discharge slowly, holding Q378 on longer thereby creating a long signal pulse. If Pin 25 is low, the .27 will discharge faster through Diode D646 holding Q378 on only for a short time, creating a short signal pulse.

INTRO

The Intro switch is a momentary switch which activates the Intro Latch circuit. With the Intro Latch on, positive voltage appears at the collector of Q390. This voltage disables the rhythm strobe and also (depending on the rhythm selected) enables either the Intro 1 or 2 Strobe Keyer. The outputs of the Intro 1 and 2 Strobe Keyers are connected to the ROM where they perform the same function as the rhythm strobe - (see Circuit Description for Rhythm Strobe). Turning on the Waltz or Swing Waltz rhythm selector switches removes the positive voltage from the "on" of the Intro switch by applying a ground via the Intro disable line. This disables the Intro on these two rhythms.

Q387, Q388 INTRO LATCH

Pressing the Intro switch momentarily applies a positive voltage to the base of Q388 turning it on. When Q388 turns on, it lowers the voltage on the base of Q387. This causes Q387 to turn on which reapplies voltage to the base of Q388 and holds it on. These two transistors remain latched in this manner for the duration of the Intro set. With Q388 held on, a positive voltage is applied to the base of the Intro Switcher Q389, and also to the bases of Q351, Q359 & Q360 disabling the Strum, Arpeggio and Boogie Bass Triggers (see Drawing 19).

Q389 INTRO SWITCHER

Positive voltage from Q388 is applied to the base of Q389 causing Q389 to turn on. When Q389 turns on, it performs two functions: 1) It lowers the voltage on the base of the Intro Enable Q390 turning it on, and 2) It momentarily lowers the voltage on the base of the Intro Reset Q364, via the Intro Clock Reset Line, and turns it on. At the end of the Intro set, the collector of Q389 goes positive and applies a positive pulse through Diode D658 to the base of the Reset Inverter Q367. This causes Q367 to conduct which applies a negative pulse to Pins 3, 5 and 6 of the counter. This resets the counter and insures that the rhythm will start at the first timing point.

Q364 INTRO RESET

The voltage on the base of Q364 is lowered when the Intro Switcher Q389 turns on. This causes Q364 to momentarily conduct bypassing Clock Transistor Q365 and resetting the collector of Q365 to a positive output for the start of the Intro.

Q390 INTRO ENABLE

When the Intro Switcher Q389 conducts, the voltage on the base of Q390 is lowered, causing it to turn on. When Q390 turns on, it performs four functions: 1) It provides the voltage supply for the Intro 1 and 2 Strobe Enable circuits; 2) It applies voltage to the base of Q368, lighting the Intro Lamp; 3) It applies a positive pulse through Diode D659 to the base of Q367, causing Q367 to conduct. This creates a negative pulse on Pins 3, 5 and 6 of the Counter IC200 resetting the counter for positive output for the start of the Intro, and 4) It neutralizes the 10K load through Diode D665, causing the voltage to rise on the base of the Rhythm Strobe Disable Q396.

Q396 RHYTHM STROBE DISABLE

When the Intro Enable Q390 conducts, it applies positive voltage through Diode D665 which neutralizes the 10K load there. This causes the voltage to rise on the base of Q396 which turns it off. When Q396 turns off, it removes the voltage supply to the Rhythm Strobe Transistor Q397, disabling the rhythm strobe pulse.

Q394, Q395 INTRO 1 STROBE ENABLE & STROBE KEYER

The Intro 1 strobe is used for Intro on all rhythms except triplet rhythms. With a rhythm on that is not a triplet, the positive voltage from the Intro Enable Q390 is applied to the base and emitter of Q394. The base voltage will be lower because of the 10K load through Diode D670 and Q394 will conduct and supply positive voltage to two places: 1) Through Diode D672 and a 3.3K resistor to the Clock Multi-vibrator. This slows down the clock for the Intro set and 2) Through Diode D673 to the emitter and base of the Intro 1 Strobe Keyer. Each time the output from the Strobe Driver Q354 is low, Q395 will conduct, producing a strobe pulse at its collector. This pulse is then connected to Pin 13 of the ROM and performs the same function as the rhythm strobe. (See Rhythm Strobe circuit description.)

Q391, Q392 INTRO 2 STROBE ENABLE AND STROBE KEYER

The Intro 2 strobe is used for Intro on triplet rhythms. With a triplet rhythm on, ground is applied to Diode D667 via the triplet enable line. This causes the voltage from the Intro Enable Q390 to be applied to the base and emitter of the Intro Strobe Enable Q391. The base voltage will be less than the emitter voltage and Q391 will turn on and apply positive voltage to three places: 1) Through Diode D669, neutralizing the 10K load there and preventing a voltage drop on the base of Q394 which keeps Q394 from conducting, thereby disabling the Intro 1 Strobe; 2) Through Diode D668 to the emitter of the Ballad, Intro Clock Slow Down Switcher Q380 and 3) To the emitter and base of the Intro 2 Strobe Keyer. Each time the output from the Strobe Driver Q354 is low, Q392 will conduct, producing a strobe pulse at its collector. This pulse is then connected to Pin 14 of the ROM and performs the same function as the rhythm strobe. (See Rhythm Strobe circuit description.)

Q380 BALLAD, INTRO CLOCK SLOW DOWN SWITCHER

This transistor is only used when the Ballad Rhythm is on and the Intro tab is activated. Positive voltage is supplied to the emitter of this transistor from Q391 through Diode D668. With the Ballad rhythm selector switch on, ground is applied to Q380's base via the Ballad Intro Slow Down Enable Line. This lowers the voltage on the base of Q380 and turns it on. When Q380 turns on, it applies positive voltage through a 2K resistor to the Clock Multi-Vibrator and slows down the clock for this Intro set.

Q386 INTRO END SWITCHER

At the end of the Intro sequence Pin 14 of the Resetable Counter IC200 goes low, momentarily lowering the voltage on the base of the Intro End Switcher Q386. This turns on Q386 which applies positive voltage to the base of Intro Latch Transistor Q387. This turns off Q387 which removes positive voltage from the base of Latch Transistor Q388 which also turns off. This removes positive voltage from the base of the Intro Switcher Q389 and it turns off, removing the load from Intro Enable Q390 which also turns off. When Q390 turns off, the 10K load through D665 is no longer neutralized and a voltage drop results on the base of Q396 Rhythm Strobe Disable. This causes Q396 to turn on, supplying voltage to the Rhythm Strobe Transistor Q397 and the rhythm voice resumes playing.

Q383 INTRO HOLD RESET

The Intro Hold Reset only functions when the Intro Switch is being held on or is pressed directly after the Intro set. Positive voltage is applied to the collector of Q383 from the Intro Switch, but Q383 is held on during the Intro set by positive voltage from Pin 14 of IC200 causing its collector to be at a low level. At the end of the Intro set, Pin 14 makes a negative transition turning off Q383 which applies a positive voltage to reset Inverter Q367. This resets the Counter IC200 back to the first timing point for the next Intro set.

Note: This reset makes it possible to play two Intro sets in succession. If the Intro switch was held on and this reset failed to function, a dead measure would exist between Intro sets.

INSTRUMENTATION

[See Schematic 21]

The instrumentation circuits produce the instrument voices for the rhythm. The generator circuits are tied together at their output and applied to the rhythm preamp where the voices are amplified and sent via the rhythm volume control to the rhythm output amp.

Q413, Q414 BASS DRUM PULSE AMP AND GENERATOR

Negative pulses from IC201 Pin 40 of the ROM are applied to the base of the Bass Drum Pulse Amp Q413, lowering the voltage and momentarily turning Q413 off. When Q413 turns off, voltage at the junction of the .82 capacitors is lowered, causing the Bass Drum Generator to oscillate, producing a short audio signal of diminishing amplitude. This signal is then amplified and applied to the rhythm preamp.

Q410-Q412, Q415-Q417 RHYTHM GENERATORS

The rhythm generators are tuned resonant circuits with an output amplifier transistor. Negative voltage pulses from the ROM IC201 cause these circuits to oscillate, producing short audio signals of diminishing amplitudes. The outputs are then combined and applied to the rhythm preamp.

Q421, Q422, Q423 NOISE GENERATOR, PREAMP, AMP

The noise generator produces a random noise signal which is then amplified by the preamp and amp. The output for the noise signal is the collector of Q423 and when either the Snare, Cymbal or Brush noise keyer circuits operate, this signal is passed through Diode D734, D735 or D736 to the Snare, Cymbal or Brush voicing amps.

Q418, Q419, Q420 SNARE NOISE PULSE DETECTOR, KEYER & VOICING AMP

When Pin 6 of the ROM IC201 is low, the voltage is lowered on the High-Drum and Low-Drum generators causing them to oscillate producing the High and Low Drum voices. These audio signals are then combined and routed to the rhythm preamp. Also, when Pin 6 goes low, the positive voltage is removed from the base of the Snare Noise Pulse Detector Q418, turning it off. When Q418 turns off, its collector goes high and applies positive voltage to the base of Q419, Snare Noise Keyer, turning it on. This causes positive voltage to turn on Diode D734 which allows noise signal to pass to the Snare Noise Voicing Amp Q420, where it is voiced and amplified for proper tonality. The voiced noise signal at the output of Q420 passes through the Snare Noise

Adjustment VR45 and combines with the High and Low Drum signals, together creating the Snare Drum voice. This signal is then applied to the Rhythm Preamp Q432. Turning on the Snare Cancel pushbutton applies a positive voltage to the base of Q418 turning it on, disabling Keyer Q419 and cancelling the Snare Drum.

Note: The ROM outputs are normally high (or positive).

BRUSH KEYING

[See Brush Length Control]

Q428, Q429 BRUSH ONE-SHOT MULTI-VIBRATOR

When Pin 21 of the ROM IC201 goes low, the base voltage on Q429 is lowered, turning it off. When Q429 turns off, it applies a positive voltage pulse to two places: 1) To the base of Q428. This turns on Q428 which momentarily keeps the base voltage off Q429 holding Q429 on and 2) To the base of the Brush Noise Keyer Q430.

Q430 BRUSH NOISE KEYER

A positive voltage pulse is applied to the base of the Brush Noise Keyer Q430 each time the brush one-shot multi-vibrator conducts. This positive voltage turns Q430 on which applies a positive voltage to Diode D736 turning it on. This allows noise signal to pass to the brush voicing amp. The voltage from Q430 also charges the 8 uf capacitor at its emitter and when Q430 turns off, this capacitor discharges holding D736 on for the duration of its discharge. The length of discharge time is determined by variations on the Brush Length Control Line.

Q431 BRUSH VOICING AMP

Noise signal is applied to Q431 through Diode D736. Here the signal is voiced and amplified for proper Brush tonality. The signal then passes through the Brush Adjustment VR48 and is applied to the Rhythm Preamp Q432.

CYMBAL KEYING

[See Cymbal Length Control]

Q424, Q425 CYMBAL ONE-SHOT MULTI-VIBRATOR

When Pin 7 of ROM IC201 goes low, the base voltage on Q425 is lowered, turning it off. When Q425 turns off, it applies a positive voltage pulse to two places: 1) To the base of Q424. This turns on Q424 which momentarily keeps the base voltage off Q425, holding Q425 on and 2) To the base of the Cymbal Noise Keyer Q426.

Q426 CYMBAL NOISE KEYER

A positive voltage pulse is applied to the base of the Cymbal Noise Keyer Q426 each time the Cymbal one-shot multi-vibrator conducts. This positive voltage turns Q426 on which applies a positive voltage to Diode D735 turning it on. This allows noise signal to pass to the Cymbal Noise Voicing Amp. The voltage from Q426 also charges the 8 uf capacitor at its emitter and when Q426 turns off, this capacitor discharges holding D735 on for the duration of its discharge. The length of discharge time is determined by variations on the Cymbal Length Control Line.

Q427 CYMBAL VOICING AMP

Noise signal is applied to Q427 through Diode D735. Here the signal is voiced and amplified for proper Cymbal tonality. The signal then passes through the Cymbal Adjustment VR47 and is applied to the Rhythm Preamp Q432.

Q432 RHYTHM PREAMP

The rhythm preamp amplifies all audio signal from the instrumentation circuits. These signals are then applied through the Rhythm Volume Control VR49 to the rhythm output amp.

Q433 RHYTHM OUTPUT AMP

Audio signal from the Rhythm Preamp is converted into a low impedance output signal by the Rhythm Output Amp Q433. This signal is then routed to Main volume regulator circuit.

MANUAL RHYTHM

Using the Manual Rhythm permits several of the Rhythm Instrumentation voices to be controlled independently of the ROM IC201. At keydown, voltage from the Lower Keyboard Keyswitches is developed into a trigger pulse and applied to the Snare Drum Switcher Q402 and the Noise Keyer Q407 via the Manual Rhythm pushbuttons. Pulses from the Pedal Cancel Trigger are used for the Bass Drum and Cymbal. Pedal keying voltage is applied to the Brush Shimmer Generator Q401 and through the Brush pushbutton to Noise Keyer Q407. The Snare and Bass Drum Switchers trigger instrumentation generators which develop the proper drum tone and applies this audio to the Rhythm Preamp Q432. The Noise Keyer Q407 is common to the Cymbal and Brush switches. When Q407 is keyed, noise is applied to a voicing circuit where it is voiced and then routed to the Rhythm Preamp.

Q400 LOWER KEYBOARD MANUAL RHYTHM TRIGGER

The input to Q400 is connected to the Lower Keyboard Keyswitch Buss(C1-C4). With no keys depressed, a 24-volt potential is felt at the input of the .05 capacitor. At keydown, this voltage is lowered, developing a negative pulse across the .05 capacitor. This turns off Q400 and applies a positive pulse to the Cymbal Length Switcher Q405 and through switches to the Snare Drum Switcher Q402 and Noise Keyer Q407.

Q402 SNARE DRUM SWITCHER

A positive pulse from Q400 to the base of Q402 momentarily turns on Q402 which applies a low to the circuitry associated with the Snare Drum. The voicing for the Snare Drum is developed as described above for Q418, Q419 and Q420 Snare Noise Pulse Detector, Keyer and Voicing Amp. Note that the Snare Cancel Switch will affect the Manual Rhythm Snare Drum.

Q407, IC204, Q408, Q409 NOISE KEYER, GENERATOR AND VOICING

A positive pulse from Q400 is routed 1) through D719, D720 and the Cymbal switch and 2) through D719, D722 and the Brush switch to the base of Q407. This voltage turns on Q407 which applies a positive voltage to Q408 and foreward biases Diode D723 which applies random noise to the Noise Voicing transistors Q408 and Q409 where the signal is voiced and amplified for proper tonality. The signal then passes to Rhythm Preamp Q432.
Note: The Cymbal and Brush will have an identical tone and length when triggered from the lower manual.

Q403 BASS DRUM SWITCHER

Each time a bass pedal is pressed, a pulse is developed across a .22 capacitor. This momentarily lowers the voltage on the base of Pedal Cancel Trigger Q164 turning it off. (See Schematic 8). A positive pulse is applied to the base of Q403. This turns on Q403 momentarily lowering the voltage at its collector which applies a low to the Bass Drum Pulse Amp Q413. The voicing for the Bass Drum is developed as described above for Q413, Q414 Bass Drum Pulse Amp and Generator.

Q404, Q405, Q406 PEDAL CYMBAL LENGTH REGULATOR & SWITCHERS

When a pedal is pressed, 1) A positive pulse is applied to the base of Q404 turning on Q404 and applying a positive pulse to the Noise Keyer Q407; 2) The pedal pulse is also routed through D718 and D720 to Q407 to give the Cymbal a slight accent at pedal keydown and 3) A DC voltage is applied from the Pedal Keydown Detector Q181 (see Schematic 8) to the base of Q406 turning on Q406 which holds Q405 off. When the pedal is released, the base of Q405 is ungrounded and positive pulses from lower keyboard Manual Rhythm Trigger Q400 will now reach the base of Q405. A pulse from Q400 will turn on Q405, momentarily grounding the base of Q404 which prevents the Pedal Cymbal from sustaining.

Q401 PEDAL BRUSH SHIMMER GENERATOR

Pressing a pedal applies DC voltage to the collector and base of Q401 turning it on. Audio signal from the D#3 (155 Hz) and E3 (164 Hz) is hetrodyned by Q401 and applied to a filter circuit. The filter removes all but the 9 Hz frequency. This is routed through D721 and the Brush switch to the Noise Keyer, modulating the noise.

SCHEMATIC 22

ORCHESTRAL SYMPHONIZER LATCH

IC207, IC208 8-BIT PRIORITY ENCODER

The primary function of the priority encoders is to provide a binary address for the active input with the highest priority. The order of priority is from top to bottom as shown on Schematic 22. The least significant bit appears at Pin 9 and the most significant at Pin 14. Pin 14 is normally low and goes high when a preset switch associated with IC207 is on. Pin 15 is normally high and goes low when an input is active. Pin 15 of IC207 is connected to Pin 5 of IC208. When there is an active input to IC207, Pin 15 goes low disabling IC208. Pin 15 of IC208 will also go low at this time. The priority encoders only have an output when a preset switch is on. Since the switches are momentary, the binary output from the encoders is only present while the preset button is being held. The binary output is then applied to the latch circuit.

IC209-IC214 ORCHESTRAL SYMPHONIZER LATCH

The latch circuit consists of IC209-IC214. Its function is to enable the Decoder IC215 and latch the binary address from the encoders into Decoder IC215. The latch circuitry will cancel a previously on preset by pressing a new preset or cancel a preset by repressing the same preset button.

ACTIVATING A NEW PRESET

Pressing a new preset switch applies a binary address corresponding to the preset switch being held, from the encoders to the D inputs of IC209 and

IC210. If at least one of the D inputs is at a different level from the Q outputs, then one or more of the exclusive OR gates IC211 A-D will go high. This high level is inverted through IC212 and disables Latch Cancel Counter IC213B. (When a preset switch is pressed, Pin 15 of IC208 goes low, applying the low to the Reset inputs of IC213A&B. IC213A&B will count when the Reset input is low and the Enable input is high.) Initially, the Q outputs of IC213A&B are low. The Q outputs are applied as inputs to Counter Enable IC212C. Since both inputs to IC212C are low, the output of IC212C is high which enables IC213A. After eight positive transitions of the clock (220 Hz from A Divider) are applied to Pin 9 of IC213A, the Q output Pin 14 goes high. This high accomplishes three functions: 1) it enables the Decoder, 2) it clocks the Latch Flip-Flops IC209 & IC210 and 3) it disables IC213A. To enable the Decoder IC215, the high from IC213A is inverted through IC214C and applied as a low to IC214B. Any low applied to a NAND gate applies its output high. The high output of IC214B is applied to IC214A Pin 12. Pin 13 of IC214A is also high (because both inputs to IC212B are low). The output of IC214A goes low which is applied to IC214B. This now locks the output of IC214A low which enables the Decoder IC215. The Q output from IC213A is applied to the clock inputs of the Latch Flip-Flops IC209 & IC210, transferring the binary address at the D inputs to the Q outputs and to the inputs of the Decoder IC215. This binary address causes one of the Decoder outputs (Pins 1-11, 13-17) to go low activating a new preset voice. The Q output from IC213A is applied to IC212C and IC212D. Any high applied to a NOR gate applies its output low. This low disables IC213A&B and locks it in its present state until the active preset button is released which resets the Q outputs of IC213A&B low.

CANCELLING A PRESET

If the preset switch that was activated is pressed again, the binary address at the D inputs of IC209 and IC210 will be identical to the binary address latched at the Q outputs. Both inputs to each exclusive OR gate will be at the same level causing the outputs to be low. This low is inverted by IC212D and enables IC213B. After four positive transitions of the clock (220 Hz from A Divider), the Q output of IC213B goes high. This high is inverted through IC212C and disables IC213A. The Q output from IC213B is also applied to Latch Cancel IC212B. Any high to a NOR gate applies its output low. This low is applied to IC214A driving its output high. The input to Pin 9 of IC214B is also high (due to the low Q output of IC213A) which causes IC214B to have a low output which is applied to IC214A. This locks its output high and disables the Decoder IC215. The Q outputs of IC213A&B will reset low when the preset button is released. If it is desired to reactivate a cancelled preset, the high from IC214A Pin 11 will be routed through Diode D756 which will disable the Latch Cancel Counter and enable the binary address to be latched into IC209 and IC210.

IC215 DECODER

The binary address from the latch circuit is applied to the decoder where it generates one of sixteen outputs. The decoder outputs are normally high and go low when active. Pressing a preset switch applies a low to the output pin corresponding to the active input of the encoders. This enables the lamp driver and DC switcher circuits.

Q436-Q451 LAMP DRIVERS AND DC CONTROL SWITCHERS

The low output from the active decoder line is applied to the base of a lamp driver and DC control switcher turning on this PNP switcher. When the switcher turns on, it lights the preset lamp at its collector and also applies positive voltage to various control circuits which give the character to the voice chosen.

Q452, Q454-457, Q459, Q461-470 SWITCHER DRIVERS

The low output from the active decoder line is applied to the base of a switcher driver transistor, causing it to turn off, which applies positive voltage to the FET switchers associated with the selected voice. This allows the audio signal from the various voicing circuits to pass to the power amplifiers. Some switcher enablers also apply voltage to the base of an orchestral chorus switcher.

Q453, Q458, Q460 ORCHESTRAL CHORUS SWITCHERS

Some of the Orchestral Symphonizer voices have a chorus effect. With one of these voices on, a positive voltage is routed to the base of the Orchestral Chorus 1, 2 or 3 Switcher. This turns on the chorus switcher enabling the chorus circuitry and regulating the amount of chorus for the voice chosen.

IC214D MANDOLIN/BANJO "ON" GATE

Turning on the Orchestral Mandolin or Banjo presets applies one of the inputs to IC214D low. This applies a high to the Mandolin and Banjo Enable Line.

SCHEMATIC 23

ORCHESTRAL SYMPHONIZER CONTROL

CANCEL UPPER & ORCHESTRAL TO LOWER LATCHES

The Cancel Upper and Orchestral to Lower Latches consist of a switch, inverter and a D Flip-Flop. IC68 is a Hex Schmitt trigger. It has a specific threshold voltage. Pressing the Cancel Upper or Orchestral to Lower switch drops the input of IC68 below its negative threshold, resulting in a high at its output. As the switch is held in, a phenomenon called switch bounce occurs. The switch bounces and the .1 capacitor charges and discharges, but the voltage never reaches the positive threshold of IC68 and its output remains high until the pushbutton is released. (If a normal inverter was used in this circuit, its output would change with each bounce of the switch. This would clock the input of IC#75B or IC71B an indeterminate number of times, making it impossible to determine the end state of the Flip-Flops). When the output of IC68 goes high, it applies a pulse to the clock input of IC75B or IC71B. The Flip-Flops are normally in a set condition - Q high and Q bar low. After clock, the outputs change state and will remain in this condition until the Cancel Upper or Orchestral to Lower button is pressed again.

Q475, Q477, Q478 LAMP DRIVER, FLUTE AND PERCUSSION CANCEL SWITCHER, R/S CANCEL SWITCHER

When IC75B is clocked, the Q bar output goes high and turns on Q475, lighting the lamp which is part of the Cancel Upper switch. The Q output goes low. If at this time no Orchestral Symphonizer preset is on, the base of Q477 is high and nothing happens. Pressing an Orchestral Symphonizer preset causes the base of Q477 to go low. With the Q output of IC75B low and an Orchestral Symphonizer preset on, the base of Q477 is low turning off Q477 which removes ground from the Key Data Enable line, cancelling the Upper Keyboard Flute and Percussion voices (See Schematic 13). The base of Q478 goes positive, turning off Q478 removing positive voltage from the Upper Keyboard R/S DC keyswitch buss (See Schematic 2).

Q476, Q488, Q490 LAMP DRIVER, UPPER & LOWER ORCHESTRAL SYMPHONIZER BUSS DRIVER ENABLES

The Q output of IC71B is normally high. This high is applied to Q490 Upper Buss Driver Enable permitting the Orchestral Symphonizer presets to be keyed by the upper keyboard. When the Orchestral to Lower Latch IC71B is clocked, the Q output goes low disabling the Upper Orchestral Symphonizer Buss and the Q bar output goes high which causes the following:. 1) Q476 turns on, lighting the lamp which is part of the Orchestral to Lower switch. 2) Q488 Lower Buss Driver Enable turns on, permitting the Orchestral Symphonizer presets to be keyed by the lower keyboard. 3) The Cancel Upper Switcher has a voltage applied from the Q bar output of IC71B, through a 100K resistor to the base of Q477. This restores the Upper Keyboard Flutes and Reed/String voices if the Cancel Upper button had been pressed. 4) The Vibrato Delay effect is cancelled and 5) The Lower Keyboard Trigger Enable Q479 is turned on permitting voltage from the lower keyboard keydown detector to trigger the Trumpet Mute and detuning effects.

Q479-Q482 TRIGGER ENABLES, UPPER AND LOWER MUTE AND DETUNING TRIGGERS

The Q output of IC71B Orchestral to Lower Latch is normally high. This high turns on Q481 Upper Trigger Enable. When an upper keyswitch is pressed, positive voltage is applied to the base and emitter of Q482. Because the base voltage is lower than the emitter voltage, Q482 turns on which applies positive voltage to the cathode of Diode D798 and also develops a positive pulse across a .033 capacitor. When the Orchestral to Lower Latch is clocked, Q481 is disabled and the Lower Trigger Enable Q479 is turned on. Voltage from the lower keyboard keydown detector is applied through Q480 to D798 and the .033 capacitor. Q479 also applies ground to the cathode of D803 and D810. This disables the Banjo and Mandolin Repeat and disables the sustain.

Q483-Q485 TRUMPET MUTE DRIVER & SHAPERS

Q484 is biased on slightly. The path for its collector voltage before keydown is through Diode D798. At keydown D798 becomes reverse biased by the collector voltage now present from Q480, Q482 or Q185. At this time, the .1 capacitor at the collector of Q484 begins to charge. As the capacitor charges, the emitter voltage of Q485 begins to rise and Q483 begins to turn on. This lowers the base voltage on Q484 which turns on harder, causing a rise in Q485's emitter voltage which is again applied back to the base of Q483. Q483 turns on harder and the emitter voltage of Q485 continues to rise. This causes an exponential voltage rise at the emitter of Q485. The voltage continues to rise in this manner until Q483 saturates causing the emitter of Q485 to reach its maximum DC level. This waveform is applied to the Trumpet Mute filter and gates the audio signal through the filter at the amplitude of the waveform.

Q486 DETUNING PULSE SWITCHER

Turning on any one of the following voices, Classic Guitar, Electric Guitar, Clavecin, Honky-Tonk, Banjo or Mandolin lowers the voltage on the base of Q486 via the detuning pulse enable line. This causes Q486 to turn off allowing a pulse from the Upper, Lower or Pedal Detuning Trigger to pass to the Master Oscillator Q8. This pulse momentarily detunes the Master Oscillator at keydown for the above-mentioned voices.

Q489, Q491, Q492, Q495 ORCHESTRAL SYMPHONIZER BUSS DRIVERS, DRIVER AND OFF SWITCHER

Pressing an Orchestral Symphonizer preset applies a low to the base of Q495. Q495 turns off, ungrounding the base of Q492. Positive voltage turns on Q492 which applies positive voltage to Q489, Q491, Q152 and Q182. Normally, Q490 is turned on applying the DC voltage Q491 to the Upper Orchestral Symphonizer keyswitches. When the Orchestral to Lower switch is pressed, Q490 turns off and Q488 turns on applying DC voltage to the Lower Orchestral Symphonizer keyswitches.

Q493, Q494 TREMOLO CANCEL SWITCHER, BRASS TREMOLO DRIVER

Pressing the vibrato tab routes vibrato signal to the base of Q494. If a Piano, Guitar or Mandolin/Banjo preset is used, positive voltage is applied to the base of Q493 which grounds the vibrato signal at the base of Q494. This applies maximum collector voltage to the Orchestral Symphonizer Driver. If a Brass preset is on, Q493 is turned off which will now place a bias voltage on the base of Q494. The output from the vibrato oscillator is allowed to pass to the base of Q494, fluctuating the Symphonizer keying voltage which gives a tremolo effect to the brass voices.

Q496, Q497 MANDOLIN/BANJO REPEAT SWITCHER, REPEAT DRIVER

Pressing the Mandolin or Banjo presets, removes ground from the collector of Q497 via D804. Pulses from the Repeat Oscillator cause Q497 to saturate and cut off applying positive pulses to the base of Q496 which also saturates and cuts off. This gates the voltage being applied to the Orchestral Symphonizer Driver Q492 which gives the Mandolin and Banjo a repeating effect. If the Orchestral to Lower circuitry is enabled, the collector voltage at Q497 is applied to ground via D803 disabling the repeat effect when the Mandolin or Banjo is coupled to the Lower Keyboard.

Q498 LOW VOLTAGE KEYING SWITCHER

Turning on the Clavecin, Oboe, Saxophone or Krumet voices turns on Q498 by applying a positive voltage to its base via the low voltage keying line. This lowers the base voltage on Q492 which in turn lowers the Orchestral Symphonizer keying voltage for the above-mentioned voices.

Note: The normal keying voltage of approximately 38V is reduced to approximately 10V when Q498 is turned on.

Q499 PIANO/GUITAR SNUB & BRASS DISABLE SWITCHER

Turning on an Orchestral Symphonizer Guitar or Piano preset applies a positive voltage to the base of Q499. This turns Q499 on and performs two functions: 1) A snubbing voltage is applied to the Orchestral Symphonizer Snub Control Line and 2) The Brass keying line is grounded through Diode D806 disabling this keying line when a Guitar or Piano preset is on.

Q500 MANDOLIN/BANJO SNUB & BRASS DISABLE SWITCHER

Turning on an Orchestral Symphonizer Mandolin or Banjo preset applies positive voltage to the base of Q500. This turns Q500 on and performs two functions: 1) A snubbing voltage is applied to the Orchestral Symphonizer Snub Control Line and 2) The Brass keying line is grounded through Diode D807 disabling this keying line when a Mandolin or Banjo preset is on.

Q501 REPEAT SNUB SWITCHER

Positive voltage will reach the base of Q501 only when the following conditions are satisfied: 1) The Mandolin or Banjo tab is pressed, 2) The Orchestral Symphonizer is played through the Upper Keyboard and 3) The Repeat tab is on. Under the above conditions, Q501 is turned on which grounds the snubbing voltage through Q501. Positive voltage is also applied to the Sustain Length Regulators via D812, giving the Mandolin and Banjo a preset sustain length.

Q502 PIANO & GUITAR DISABLE SWITCHER

Turning on an Orchestral Symphonizer Brass preset applies positive voltage to the base of Q502 turning it on. When Q502 turns on it grounds the Piano/Guitar keying line disabling this keying line when a Brass preset is on.

Q504 PIANO SUSTAIN CANCEL

Turning on a Brass, Guitar or Mandolin/Banjo preset applies positive voltage to the base of Q504 turning it on. When Q504 turns on it grounds the Orchestral Symphonizer sustain line, cancelling sustain for the Brass, Guitar and Mandolin/Banjo presets.

Q503 GLIDE CANCEL SWITCHER

Turning on an Orchestral Symphonizer Piano preset applies positive voltage to the base of Q503 turning it on. When Q503 turns on it grounds the input to the glide circuit, cancelling glide. Pressing the glide switch at this time applies positive voltage to the Sustain Length Regulators via D811.

Q505, Q506 ORCHESTRAL SYMPHONIZER SUSTAIN LENGTH REGULATORS

A positive voltage applied to the base of Q505 from the Piano Sustain Switch or the Repeat tab (see Repeat Snub Switcher) causes the collector voltage of Q505 to decrease, lowering the voltage at the base of Q506. When Q506 turns off, a positive voltage is applied to the Common Orchestral Symphonizer Sustain Line. This voltage reverse biases D824 preventing the sustain capacitor from discharging through D824. (See Schematic 24.)

SCHEMATIC 24
ORCHESTRAL SYMPHONIZER KEYING

Q510, Q512 ORCHESTRAL SYMPHONIZER KEYER & PULSE KEYER

There are 61 upper keyboard orchestral keying circuits; one of which is shown on Drawing 24. Pressing a keyswitch with an Orchestral Symphonizer preset on applies positive voltage to the base of a Q510 through either the Brass or Piano/Guitar keying line. Only one of these keying lines can be enabled at any one time. The amplitude of keying voltage through the Brass keying line is such that Capacitor C2 charges relatively slow. This produces a steadily rising voltage at the emitter of Q510, causing the 330K resistor and capacitor C3 to charge to a changing reference. On initial keydown, this will cause the output of Q512 to vary from a wide pulse width of small amplitude to a narrow pulse width of higher amplitude and creates the breathy keydown effect for the Brass voices. After the emitter of Q510 reaches its maximum DC level, the output of Q512 will be a pulse waveform with approximately a 10% duty cycle at the frequency of the input signal. The output of Q512 then passes through Diode D827 where it is separated into groups and routed to various filtering circuits. With a Brass voice on, the sustain line is grounded and releasing the key causes any remaining capacitor charge to discharge through a D824 and a 120K resistor to ground. The keying voltage through the Piano/Guitar keying line is of a higher amplitude and is applied as a pulse to the base of Q510. This causes the emitter of Q510 to go to its maximum voltage at keydown creating a positive pulse at the collector of Q512. This pulse is routed through D828 to the strike tone amp and creates the percussive keydown effect for the Piano, Guitar and Banjo/Mandolin presets. Also, the emitter voltage from Q510 biases on Diode D830 allowing audio signal to pass to the sawtooth filtering groups. If the key is held down, the decay time of this pulse is determined by voltage on the snub line through Diode D825. After the snubbing, the remaining capacitor voltage holds on Q510 for the duration of its discharge time. If the key is released before the decay is complete, the capacitor discharges through Diode D824, a 120K resistor and Q506 to ground. (This discharge path is blocked as long as a key is being held because of the reverse bias condition of D824.) If a Piano preset is on, the glide switch becomes a sustain switch. Hitting the glide switch after the key is released, applies positive voltage via the sustain line to the cathode of Diode D824 reverse-biasing D824. This causes C2 to discharge onto the base of Q510, holding it on and creating a sustain effect.

Q511, Q513 8-, 16-FOOT SWITCHERS

When the Orchestral Symphonizer Octave Coupler Switch is in the 8-foot position, a negative voltage is applied to the base of Q511 turning on Q511 which routes keyer voltage from Q510 via Q511 to Q512. at this time the base of Q513 is positive which turns off Q513. With the Octave Coupler Switch in the 16-foot position, Q511 is turned off and the keying voltage from Q510 is routed via Q513 to Q512 one octave lower. The Orchestral Symphonizer 16-foot Low-Octave Enable Q154 is also turned on enabling Low-Octave frequencies C1-B1 to be applied to various Symphonizer filter circuits (see Schematic 7). When the Octave Coupler Switch is in the 8/16 position, the bases of Q511 and Q513 are low applying keying voltage to the 8- and 16-foot keying circuits.

Q514, Q515 ORCHESTRAL SYMPHONIZER PEDAL KEYER & PULSE KEYER

This single keying circuit is identical in operation to the 61 Orchestral Symphonizer keying circuits. See Q510 and Q512 for circuit description.

SCHEMATIC 25

ORCHESTRAL SYMPHONIZER QUALITY CONTROL

Audio signal from the pulse keyer and sawtooth keying circuits is separated into groups and routed through various filtering circuits where the tonal quality of each voice is created. The strike tone pulse is routed through IC225A where the length of this pulse is determined by regulating the DC level at Pin 3. The pulse is then filtered and used with the percussive voices of the Orchestral Symphonizer. Turning on a preset applies positive voltage from a Switcher Driver Transistor to one of the FET switchers turning it on, which allows the audio signal to pass to one of the volume regulators.

IC228, IC229, Q531, Q532 TRUMPET MUTE FILTER

This circuit is a State Variable Filter that acts in conjunction with the 800p capacitors to form an RC Low-Pass filter. Signal from the Trumpet Filter is gated through the filter at the amplitude of the drive waveform applied to Pins 5 of IC228 and IC229. The output is a low impedance signal that is routed to the Chorus Channel Volume Regulator IC231 when the Trumpet Mute preset is on.

IC226B, IC230, Q539 ORCHESTRAL SYMPHONIZER MAIN CHANNEL MIXING PREAMP, VOLUME REGULATOR & EMITTER FOLLOWER

Audio signal components of the active Orchestral Symphonizer preset are mixed and amplified by IC226B. The output of IC226B is routed to the input of the Orchestral Symphonizer Chorus circuit and also to Regulator IC230. The amplitude of the voltage applied to Pin 5 of IC230 from the Orchestral Volume Control VR51 regulates the amplitude of IC230's output signal. This signal is then passed through Q539 where it is transformed into a low impedance signal before being routed to the R/S Mixing Preamp. The signal that is routed to the chorus circuit is phase modulated and applied to the input of the Chorus Channel Volume Regulator IC231.

IC231, Q540 ORCHESTRAL SYMPHONIZER CHORUS CHANNEL REGULATOR & EMITTER FOLLOWER

Audio signal from the Orchestral Symphonizer Brass voices is applied to IC231 where the amplitude of the output signal is determined by Orchestral Symphonizer Volume Control VR51. Phase modulated audio signal from the Orchestral Symphonizer Chorus circuit is also routed through IC231. These signals are then applied to Q540 where they are transformed into a low impedance signal before being routed to the Reverb Circuit and Phase 2 and 3 Volume Regulators.

SCHEMATIC 26

ORCHESTRAL SYMPHONIZER CHORUS

Q545, Q546 & Q547 CHORUS ENABLE AND DEPTH REGULATORS

Turning on an Orchestral Symphonizer preset that has a chorus effect applies positive voltage through Diodes D877, D878 or D879 to the emitter of Q545. This turns Q545 on and effectively grounds Pin 9 of IC234 enabling the Chorus Speed Oscillator. Q546 and Q547 regulate the amplitude of the oscillator output by regulating the amount of shunt resistance at the output of the oscillator. Q546 and Q547 are normally saturated. This is the condition when a preset using Chorus 1 (Grand Piano, Harpsichord, Clavecin, Electric Guitar) is on. With Q547 saturated, Q546 has no effect on the circuit and the oscillator output sees a 1K resistor to ground through Q547. (The +11V supply appears as a ground to the oscillator output.) This condition gives the least chorus effect. Turning on the Classic Guitar preset which uses Chorus 2, applies positive voltage through Diode D875 and shuts off Q547. The oscillator output now sees an 11K shunt resistance through Q546. This gives a slightly greater chorus effect for Classic Guitar. With the Honky-Tonk or French Horn presets on, positive voltage is routed through Diodes D874 and D877, turning off both Q546 and Q547. This removes the shunt from the oscillator output, allowing it to be at its maximum amplitude. This gives a maximum chorus effect to the presets using Chorus 3. At this time the twenty mfd capacitor is referenced through the series combination of a 1K, 10K and 470K resistors to +9.5 volts.

IC234C&D AND Q548 & Q549 CHORUS SPEED AND VOLTAGE-CONTROLLED OSCILLATORS

When the Chorus Speed Oscillator is enabled, it produces a .7Hz triangular waveform at the output of IC234D. The amplitude of this waveform is regulated at the output of IC234D before being routed to the voltage controlled oscillator. The voltage controlled oscillator runs at a speed which is inversely proportional to the amplitude of the input from the speed oscillator. Since the amplitude of the input from the speed oscillator is constantly changing, the frequency of the voltage controlled oscillator varies. This in turn varies the delay time of the audio signal through the bucket brigade resulting in a phase modulated signal.

IC234A INPUT LOW-PASS FILTER

The input Low-Pass Filter prevents intermodulation by filtering out certain high frequency signals. The output of this filter is then applied to the input of the bucket brigade.

IC235 BUCKET BRIGADE

The Bucket Brigade is an analog shift register which samples the input audio signal at the rate of the Clock pulses from the Voltage Controlled Oscillator. Each time a negative clock pulse is applied to Pin 2 and then Pin 12 of IC235, the audio signal is transferred to the next stage of the Bucket Brigade until it appears as output at Pin 14. This causes a delay between the input and output signal. Since the frequency of the clock pulses are constantly varying, the delay time of the signal through the Bucket Brigade also varies, phase modulating the audio. The audio signal output from the Bucket Brigade is then applied to the low pass filter.

IC234B OUTPUT LOW-PASS FILTER

The output Low-Pass Filter filters out the high frequency clock component that is contained in the audio signal at the output of the Bucket Brigade. This phase modulated signal is then routed through the Chorus Channel Volume Regulator to the Phase 2 and 3 Power Amplifiers.

SCHEMATIC 27

REED/STRING AUTOMATIC ORGAN COMPUTER [AOC]

Automatic Organ Computer (AOC) consists of Upper Keyboard AOC keyswitches (C3-C6), Lower Keyboard DC keyswitches (C1-C4), and in the Magic Chord mode the Magic Genie AOC Decoder is used in place of the A1-A2 DC keyswitches. Listed below is an example of what happens when a C Major chord is held on the Lower Keyboard and the C6 Upper Keyboard key is pressed.

1) With the AOC tabswitch on, holding a three-finger or a one-finger Magic C Major chord (C, E and G) on the Lower Keyboard applies a positive voltage (from the C1-C4 Lower Keyboard keyswitches or the Magic Genie AOC Decoder) to the C, E and G AOC Drivers. Here the voltage is amplified and applied to the emitters of all the C, E and G AOC Keyers Q551 via Diodes D890.

2) Upon pressing the Upper Keyboard C6 Key:
   a) the C6 DC keyswitch contact (see Schematic 2) receives a positive voltage from its on buss and keys the C6 note through the Upper Keyboard Diode Keying circuitry.
   b) the C6 AOC keyswitch contact is grounded by its on buss which lowers the voltage on the base of nine AOC keyers - namely C#5, D5, D#5, E5, F5, F#5, G5, G#5 and A5. Since in this range only E5 and G5 have voltage applied to their emitters from the Lower Manual keyswitches or the Magic Genie AOC Decoder (via the AOC Drivers) they are the only two AOC keyers that will conduct, applying voltage to the Upper Keyboard E5 and G5 Diode Keying circuit. Thus, E5 and G5 will be heard along with C6. The output from the AOC Drivers is also applied to the Golden Harp Enable Transistors Q583.

Q554 GOLDEN HARP ENABLE

Each time a Lower Keyboard key is pressed, the voltage at the base of Q553 will decrease turning on Q553. This applies a positive voltage to the base of Golden Harp Enable Switcher Q554 turning it on. A low is routed to the Harp Enable Line (Schematic 28) and the Harp Data Enable Gate (Schematic 13).

SCHEMATIC 28

GOLDEN HARP

IC238B & IC240B HARP SPEED OSCILLATOR

The Harp Speed Oscillator produces a symmetrical square wave output at Pin 11 of IC240B. The frequency of this output is adjustable from 3 to 20Hz by the Harp Speed Control VR60. If the Rhythm Sync Switch is on and a rhythm is on, Pin 1 of IC238B is held high, disabling the Harp Speed Oscillator. At this time the rhythm clock output is routed through Diode D902 to the scan oscillator and the speed of the Harp is controlled by the rhythm. If the Rhythm Sync Switch happens to be on and no rhythm is on, the input from the rhythm clock at the anode of D902 is reset to a low level and Pin 1 of IC238B is grounded through the Rhythm On Switcher Q351. This enables the Harp Speed Oscillator which now has an output through Diode D901 and D903 to the Scan Oscillator.

Q580 HARP FOOTSWITCH ENABLE

The Golden Harp and the Magic Chord Minor Enable are activated from the same footswitch.

When the Magic Chord tab is off, a positive voltage from Q348 turns on Q580 applying positive voltage via Diodes D895 and D905 to Pin 8 of IC238C disabling the Scan Oscillator. When the Minor/Golden Harp Footswitch is activated, the emitter voltage of Q580 is grounded through D894. If a lower keyswitch is pressed, Q554 turns on which provides a low enable for the Scan Oscillator. With the Magic Chord tab on, Q580 is turned off removing this DC voltage from the Harp Enable line. Positive voltage is applied through the Golden Harp tab and D896 to the Harp Enable line, disabling the Scan Oscillator. If the Golden Harp tab is placed to the on position, the positive voltage is removed from the Harp Enable line. Pressing a Magic Chord keyswitch will apply AOC Data from IC194 to the AOC Drivers. Q554 will be turned on applying a low to the Scan Oscillator. The Golden Harp circuit will continue to play as long as AOC Data is being applied to the AOC Drivers.

IC238C & IC238D SCAN OSCILLATOR

To enable the Scan Oscillator, the following conditions must be met: 1) the Q output of IC243A must be low, 2) a low is applied to D903 from the Inverter or the Rhythm Clock, 3) the Minor/Golden Harp Footswitch is activated and 4) a lower keyswitch is pressed. When the inputs to IC238C Pin 8 are low, the Scan Oscillator is enabled. The Oscillator runs at a frequency of approximately 700Hz producing outputs that are inverted from each other at Pins 10 and 11 of IC238. The output from Pin 10 is applied to Up/Down Counter IC246 and the output from Pin 11 is applied to the Stop Scan Triggers IC241B and the Pulse Swallower Reset IC240C.

IC246, IC247 UP/DOWN COUNTER & DECODER

With a lower keyswitch pressed and the Golden Harp footswitch on, Up/Down Counter IC246 is enabled. The Up/Down Counter advances each time a positive pulse is applied to Pin 15 and generates one of sixteen binary outputs at Pins 6, 11, 14 and 2. The least significant bit appears at Pin 6 and the most significant bit at Pin 2. If Pin 10 is held high, it generates a binary up count; if Pin 10 is held low, it generates a binary down count. Applying a positive pulse to Pin 1 resets the counter to its zero count. The output of the counter is applied to the Up/Down Decoder IC247 where it generates one of sixteen outputs. The decoder outputs are normally high and go low when active. They are sequentially enabled. Pin 1 being the lowest count and Pin 17 the highest. Pins 1 or 17 trigger the octave counter, depending on the position of the Down only switch. Pins 2-14 (excluding 12) sequentially enable the 12 Enable Transistors Q583. The outputs on Pin 15 and 16 are not used.

IC241A&B, IC243A STOP SCAN TRIGGERS & STOP SCAN

The Harp Speed Oscillator and Stop Scan circuit work together to control the scan oscillator which in turn is used to generate the stepping pulses for the Up/Down Counter IC246. When the output from the Harp Speed Oscillator, the Q output Pin 1 of IC243A and the Harp Enable and Reset Line are low, the scan oscillator runs producing the stepping pulses for the Up/Down Counter IC246. Applying a pulse to Pin 15 of IC246 causes one of the decoder lines of IC247 to go low. If the lower manual key for that stage is not being held, nothing happens and the scan oscillator continues to oscillate, generating another step on its next cycle which advances IC247 to the next note. If the next note is present from the lower manual, positive voltage is routed through Diode D914 to Pin 8 of IC240C and also to Keyers Q584. On the next half cycle of the Scan Oscillator, Pin 11 of IC238D applies a high to Pin 13 of IC241B. The Q bar output of IC243B is also high, (this Q bar output only changes state when the Counter IC246 is transferring from an up count to a down count or from a down count to an up count) and is applied to Pin 12 of IC241B causing Pin 11 of IC241B to go high. The output from Pin 11 is applied to Pin 9 of IC241A. Pin 8 of IC241A is high due to the active lower manual note.

This causes the output of IC241A to go high, clocking Pin 3 of IC243A. The Q output Pin 1 of IC243A now goes high and is applied through Diode D904 to Pin 8 of IC238C. This locks the output of IC238C high and disables the scan oscillator. The stop scan operation has taken place while the output of the Inverter Q579 is still at a low level. On the next half cycle of the Harp Speed Oscillator, Q579 makes a positive transition and resets the Q output of IC243A to a low level. The scan oscillator is still inhibited through Diode D903 due to the high level of Q579. On the next half cycle of the Harp Speed Oscillator, Q579 goes low and the scan oscillator runs again at a rate of 700Hz and searches for the next active note in the sequence.

Q584 GOLDEN HARP KEYERS

This circuit contains 36 Emitter Follower Keyers Q584. The keyers are arranged in 12 identical circuits, each consisting of 3 keyer transistors. Each of the 12 circuits corresponds to a note in an octave. Each of the 3 keyers in a circuit is associated with a different octave starting at the first octave and running through the third octave. Up/Down Decoder IC247 provides enable outputs (low levels) sequentially for each note of an octave. For example, if IC247 Pin 2 is low, C# Enable Q583 is turned off. If at this time the C#1, C#2 or C#3 Lower Manual Keyswitch is pressed, a positive voltage is applied to the 2.2K collector resistor of the C# Enable Q583. The positive voltage is 1) applied through Diode D914 (C# circuit) triggering the stop scan circuitry, 2) routed to the base of the C#1, C#2 or C#3 Keyer Q584, depending on which octave lead is ungrounded at that time. Only one octave lead is ungrounded at any one time. The voltage then turns on Q584 (C# circuit) and keys a note through the Upper Diode Keying circuits and 3) applied to the C# input of the Harp Data Collector IC104.

IC239 & Q582 UP/DOWN COUNT ENABLE GATES & DRIVER

In normal operation (virtuoso off) the output of IC238A Pin 4 is always low. This will cause Pin 11 of IC239C and Pin 8 of IC239D to lock in a high state. Also the low output of IC238A is inverted through IC239A locking Pin 6 of IC239B in a high state. In the up count mode of operation, the base of Q582 is low causing its collector to be high. This high level is applied to Pin 5 of IC239B. Since Pin 6 of IC239B is locked high its output at Pin 4 will be low. This will also cause Pin 9 of IC239D to be low. Since Pin 8 of IC239D is locked high, its output at Pin 10 will go high. This high output is applied to Pin 10 of IC246 Up/Down Counter, causing it to generate a binary up count. In the down count mode of operation, positive voltage will be routed to the base of Q582, turning it on which puts its collector at a low level. This low is applied to Pin 5 of IC239B. Since Pin 6 of IC239B is locked high, its output at Pin 4 and correspondingly the input Pin 9 of IC239D will go high. Since Pin 8 of IC239D is locked high the output of IC239D will go low. This low level is applied to Pin 10 of Up/Down Counter IC246, causing it to generate a binary down count.

IC240A&C and IC243B PULSE SWALLOWER & RESET

When the count changes direction, the first active note that is found in the new direction will be the same as the last active note played in the old direction. The result would be that the highest or lowest note (depending on the count direction) being held would play twice at the transfer point. The purpose of the pulse swallower circuit is to prevent this condition by not stopping the scan oscillator at the first active note after the transfer.

When there is a count direction change, the collector of Q582 makes a transition from high to low, or from low to high. If the transfer is from an up count to a down count, the collector makes a negative transition which is inverted by IC240A and applied as a positive pulse through Diode D897 to the set input Pin 9 of IC243B. If the transfer is from a down count to an up count, the collector makes a positive transition which is applied as a positive pulse through Diode D899 to the set input Pin 9 of IC243B. This pulse causes the Q bar output Pin 14 of IC243B to go low. When the first active note after the transition is reached, a positive voltage is routed through Diode D914 to Pin 8 of IC240C. On the next half cycle of the Scan Oscillator Pin 11 of IC238D goes high. This high level is applied to Pin 13 of IC241B, but this gate is now disabled due to the low level at Pin 14 of IC243B. This prevents an output on IC241B which in turn prevents the output of IC241A from going high and clocking Stop Scan Flip-Flop IC243A. Thus the scan oscillator continues to run bypassing this note in the sequence. On the next half cycle of the scan oscillator Pin 11 of IC238D goes low. This causes the output of the Pulse Swallower Reset IC240C to go high and clock Pin 13 of IC243B. This resets the Q bar output high and enables the stop scan triggers for the next active note in the sequence.

Note: Pin 13 of IC243B is clocked each time Pin 11 of IC238D goes low, but because of the condition of the J & K inputs, the same output condition is reinstated. That is, the Q bar output remains high.

IC240D, IC244 & IC245 OCTAVE COUNT TRIGGER, COUNTER & DECODER

The octave counter IC244 advances each time a positive pulse is applied to Pin 15 and is capable of generating one of sixteen binary outputs at Pins 6, 11, 14 and 2. The least significant bit appears at Pin 6 and the most significant bit at Pin 2. The maximum binary count IC244 reaches is 6 in the Up/Down 3 mode of operation. If Pin 10 is held high, IC244 generates a binary up count. If Pin 10 is held low, it generates a binary down count. In normal operation, Virtuoso off, Pin 10 is always high. Applying a positive pulse to Pin 1 resets the counter to its zero count. The output of IC244 is applied to the octave count Decoder IC245 where it generates one of ten outputs.

The octave decoder outputs are normally low and go high when active. They are sequentially enabled; Pin 3 being the lowest count and Pin 7 the highest. The count sequence is from top to bottom as shown on Drawing 28. Pins 3, 14, 2, 15, 1 and 6 sequentially enable the octave switcher transistors; Pin 7 is used as the reset pulse in the Up/Down 3 mode of operation. Three of the ten decoded outputs from Pins 4, 9 and 5 are not used.

When the Up/Down Decoder IC247 reaches its maximum count, Pin 17 (minimum count, Pin 1 in the down only mode of operation) goes low and is inverted through Octave Count Trigger IC240D, applying a positive pulse to 15 of Octave Counter IC244. This advances Counter IC244 which sequential enables the octave switchers through Decoder IC245.

UP ONLY

With the down only switch in the off position, the Golden Harp is in the up only mode of operation. Positive voltage is routed through the series switch configuration to Pin 1 of IC242B and through Diode D909 to Pin 1 of IC241C. These gates can now be enabled as the octave count advances. Q582 is cut off applying a high level to Pin 10 of IC246. When the Scan Oscillator is enabled, the Counter IC246 begins an up count. At this time, Octave Counter is at its zero count and Pin 3 of IC245 is high. This high level is inhibited by gate IC242A and there is no output to the switchers. In this condition, the bases of Q585 and Q588 are low causing Q586 and Q589 to be saturated. With Q586 and Q589 saturated, the high octave and middle octave enable lines are grounded and Q587 will be off, enabling the low octave. On the next advance of the Octave Counter, Pin 14 of IC245 goes high and turns off Q589 through Q588. When Q589 turns off, it unclamps the middle octave enable line allowing the middle octave to play. At the same time positive voltage is applied to Q587, turning it on which clamps the low octave enable line to ground. On the next advance of the Octave Counter, Pin 2 of IC245 goes high. This high level is applied to Pin 2 of IC242B. Since Pin 1 is high due to the down only switch position, the output of IC242B Pin 3 goes high and turns off Q586 through Q585. When Q586 turns off, it unclamps the high octave enable line allowing the high octave to play. At the same time, positive voltage is applied to Q587, turning it on and clamping the low octave enable line to ground. When the octave counter again advances, Pin 15 of IC245 goes high. This high level is applied to Pin 2 of IC241C. Since Pin 1 of IC241C is high due to the down only switch position, the output of IC241C goes high applying a positive voltage through Diode D907. This resets Octave Counter IC244 and Up/Down Counter IC246 back to their zero count. This sequence will continue in this manner as long as the Scan Oscillator is enabled.

DOWN ONLY

With the down only switch on, positive voltage is routed through the series switch configuration to Pin 5 of IC242A and through Diode D910 to Pin 1 of IC241C. These gates can now be enabled as the octave count advances. The positive voltage from the switch is also applied to the base of Q582 turning it on, applying a low level to Pin 10 of IC246. Also the octave advance pulse applied to IC240D now comes from Pin 1 of IC247. When the Scan Oscillator is enabled, the Counter IC246 begins a down count. At this time Octave Counter IC244 is at its zero count and Pin 3 of IC245 is high. This high level is applied to Pin 6 of IC242A. Since Pin 5 is high due to the down only switch position, IC242A has a positive output at Pin 4. This positive voltage turns off Q586 through Q585 ungrounding the high octave enable line, allowing the high octave to play. At the same time this voltage is also applied to Q587, turning it on which clamps the low octave enable line to ground.

On the next advance of the Octave Counter, Pin 14 goes high turning off Q589 through Q588 ungrounding the middle octave allowing it to play. At the same time this voltage is also applied to Q587 turning it on which clamps the low octave enable line to ground. The Octave Counter is advanced again and Pin 2 goes high, but this voltage cannot pass to the octave switches and the low octave is enabled by the saturated condition of Q586 and Q589. After the next count, Pin 15 of IC245 goes high. This high level is applied to Pin 2 of IC241C. Since Pin 1 is high due to the position of the down only switch, the output of IC241C goes high applying a positive voltage through Diode D907. This resets Octave Counter IC244 and Up/Down Counter IC246 back to their zero count. This sequence will continue in this manner as long as the Scan Oscillator is enabled.

UP/DOWN 2

With the Up/Down 2 switch on, positive voltage is routed to Pin 13 of IC242C and also from the arm of this switch to IC241D Pin 6. These gates can now be enabled as the octave count advances. Q582 is cut off applying a high level to Pin 10 of IC246. When the Scan Oscillator is enabled, the Counter IC246 begins an up count. The up count for the first two octaves operates as described in the up only mode. On the third advancement of the Octave Counter Pin 2 goes high. This high level is applied to Pin 12 of IC242C. Since Pin 13 is high due to the on position of the Up/Down 2 switch, Pin 11 of IC242C goes high. This performs two functions: 1) Positive voltage turns off Q589 through Q588 disabling the low octave and enabling the middle octave; 2) Positive voltage is applied to the base of Q582 turning it on which applies a low level to Pin 10 of IC246. This initiates a down count and the middle octave now counts down. On the next advancement of the Counter, Pin 15 of

IC245 goes high and holds the base of Q582 high. This holds the counter in the down count mode. At this time no voltage is routed to the switchers, automatically enabling the low octave which also counts down. On the next counter advance, Pin 1 of IC245 goes high resetting the Octave and Up/Down Counters IC244 and IC246 to their zero count through IC241D. This sequence continues in this manner as long as the Scan Oscillator is enabled.

UP/DOWN 3
With the Up/Down 3 switch on, positive voltage is routed to Pin 8 of IC242D. Q582 is cut off applying a high level to Pin 10 of IC246. When the Scan Oscillator is enabled the Counter IC246 begins an up count. The up count for the first two octaves operates as described in the up only mode. On the third advancement of the Octave Counter, Pin 2 of IC245 goes high and is routed through D911 to Pin 9 of IC242D. Pin 8 of IC242D is high due to the on condition of the Up/Down 3 switch. This causes the output Pin 10 of IC242D to go high. This high level turns off Q586 through Q585 and enables the high octave. Voltage is also applied to Q587 clamping the low octave enable line to ground. When the octave counter is advanced again, Pin 15 goes high. Positive voltage is routed through Diode D912 to Pin 9 of IC242D. This holds IC242D in the same state as the previous count and the high octave is still enabled. Positive voltage from Pin 15 is also routed to the base of Q582, turning it on. This applies a low to Pin 10 of IC246 which initiates a down count. This causes the high octave to play again but in the down direction. On the next count, Pin 1 of IC245 goes high which holds Q582 on, and also enables the middle octave through Q588 and Q589. This allows the middle octave to play in the down direction. When the octave counter advances again, Pin 6 of IC245 goes high holding Q582 on; the low octave is automatically enabled by Q587, since there is no output to the switchers. This enables the low octave to count down. The counter advances again and Pin 7 of IC245 goes high, resetting the octave and up/down counters to their zero count. The Up/Down 3 sequence will continue in this manner as long as the Scan Oscillator is enabled.

VIRTUOSO
In the Virtuoso mode of operation, the up/down counter will count three active notes in one direction, reverse direction for one active note, then resume in the original direction for three more active notes and so on. Turning on the Virtuoso switch turns off Virtuoso Switcher Q581. This removes the reset condition from Pulse Dividers IC237A&B, allowing them to count. IC237A&B comprise two divide-by-two dividers. The clock input of IC237A is connected to Stop Scan Trigger IC241A. The output of IC241A goes high and clocks IC237A each time an active note is found. After three active notes have been found, the Q bar outputs of IC237A&B will both be low. This causes the output of Gate IC238A to go high. This high level is applied to the up/down enable gates and will invert the existing condition at Pin 10 of IC239D. When the next pulse from the scan oscillator is applied to Pin 15 of IC246, the direction of the count is reversed and the note previous to the one that has just been played is played again. When the scan oscillator is stopped to play this note, another pulse is applied from IC241A to the Virtuoso Pulse Dividers. This inverts the output of IC238A which in turn inverts the output of IC239D. The output of IC239D is now in its original state and the counter will resume its original direction of count until three more active notes have been found. Also, when the output of IC238A goes high, it applies a low through Inverter IC239A to Pin 10 of Octave Counter IC244. If, when the count is reversed, an octave must be crossed to play the previous note, a pulse will be applied to Octave Counter IC244 Pin 15. The low on Pin 10 will allow the Octave Counter (which normally counts only in the up direction) to count down and enable the correct octave line for this note.

SCHEMATIC 29

REVERB, VOLUME REGULATORS & AMPLIFIERS

Audio signal from the Flute Collector Amp, Reed/String Mixing Preamp, Bass Emitter Follower, Rhythm Output, Orchestral Symphonizer and Phase 2 and 3 Output Amps is channelled two ways simultaneously: through the reverb circuitry and their respective volume regulators. The reverb output is then routed to the Main and Leslie volume regulators.

IC250A REVERB DRIVER
Audio output signal from the Flute Collector Amp, Reed/String Mixing Preamp, Bass Emitter Follower, Rhythm, Orchestral Symphonizer and Phase 2 and 3 Output Amps is applied to IC250A where it is amplified and connected to the Reverb Spring unit producing the reverb effect.

IC250B REVERB RECOVERY AMP
Reverberating audio signal from the Reverb Spring unit is applied to IC250B. The signal is amplified by a gain factor of approximately 33 and transformed to

a low impedance signal before being routed to the Main and Leslie Volume Regulators via the Reverb Length Control VR62.

Q595 VOLUME REGULATOR DRIVER

The amplitude of the signal at the output of the volume regulators is controlled by the Volume Regulator Driver Q595. Pressing the expression shoe down moves the lamp in Expression Pedal Photocell P2 closer to the photocell, decreasing the photocell's resistance, which increases the voltage on the base of Q595. This in turn increases the emitter voltage of Q595. Applying this voltage to Pin 5 of the volume regulators increases the amplitude of their output signal.

IC251, Q596 MAIN VOLUME REGULATOR & OUTPUT AMP

Audio signal from the Reed/String Mixing Preamps, Bass Emitter Follower, Rhythm Output Amp and Reverb is applied to IC251 where the amplitude of the Main output signal is regulated. Some signal from the Bass Emitter Follower bypasses IC251 allowing some Bass signal to pass to the Main Output Amp Q596 when the organ is at minimum volume. The output of IC251 is applied to Q596 where it is amplified before being routed to the Main power amplifier.

IC162D LOW PASS BASS FILTER

The Low Pass Bass Filter filters out the high frequency bass signal that is outputted from the Bass Emitter Follower. The low frequency bass audio is then applied to the Leslie Volume Regulator.

IC252, Q597 LESLIE VOLUME REGULATOR & OUTPUT AMP

Audio signal from the Flute Collector Amp, Low Pass Bass Filter and the Reverb is applied to IC252 where the amplitude of the Leslie output signal is regulated. The output of IC252 is applied to Q597. Here the signal is amplified before being routed to the Leslie power amplifier.

IC253, IC254 PHASE 2 AND 3 VOLUME REGULATORS

Audio signal from the Phase 2 and 3 Output Amps and the Orchestral Symphonizer is applied to IC253 and IC254 where the amplitude of these signals is regulated. The outputs from the Volume Regulators is then routed to the Phase 2 and 3 Power Amplifiers.

Q598-Q604 AND IC255 MAIN, LESLIE, PHASE 2 CHORUS AND PHASE 3 CHORUS AMPS

These four amplifiers are identical. They are self-biasing with a complimentary output configuration. The power output is rated at 35 watts RMS for each amplifier. The function of the preamp is to boost the signal voltage to a point where they can be used by the driver circuit. Preamp Q600 senses the signal at the output of the amplifier and controls it by regulating the signal input at Preamp Q599. The driver inverts the audio voltages so the outputs work in push-pull. The outputs convert the voltage from the driver into high current, low voltage output signal that is connected via the speaker enable relay contacts to the speakers.

With no signal input, Bias Switcher Q602 is on and there is virtually no current being drawn by the outputs. IC255A&B have a total gain of approximately 1000. When an input signal as small as one milli-volt is applied to the amp, the bias on the base of Q602 is overcome and it shuts off, enabling the amplifier.

Q605 SPEAKER ENABLE RELAY DRIVER

At organ turn on, the DC voltage applied to the base of Q605 sees a ground through the 15uf capacitor. As the capacitor charges, the voltage at the base of Q605 increases which eventually turns on Q605 and activates the Speaker Enable Relay. The time delay is the RC time constant determined by the 150K resistor and the 15uf capacitor. When a headphone is used, the base of Q605 is grounded through a 1K resistor which causes RL1 to de-energize.

SCHEMATIC 30

POWER SUPPLY

AC line voltage is converted into positive and negative DC supply voltages using step down Transformer T1 and Rectifier Bridge D935. Regulators IC260-IC266 are used as voltage regulators on several supply lines. IC260 has a 100 ohm DC offset resistor. The output of IC260 will measure 9.5 volts to ground reference. IC263 has a DC offset Voltage Adjust VR67. It is adjusted for 14 volts at the output of IC263. Some of the voltage divider circuits are located on various boards throughout the organ. They are enclosed in dotted boxes with a note for their location. Q609 and Q610 regulate voltages for the Pedal and DC Control voltages. A 5-amp slo-blo fuse is employed in the primary circuit of the power supply to prevent component damage which may be caused by a short circuit.

TR1 LESLIE TREMOLO SWITCH

Turning on the Leslie Tremolo switch applies 14 volts to Photocell Lamp P8, illuminating the lamp. The decrease in the photocell resistance activates the Triac TR1 applying AC voltage to the Leslie motor.

ADJUSTMENTS

SCHEMATIC 1

VR1 VIBRATO SPEED ADJUSTMENT
Vibrato speed may be adjusted by using a small screwdriver. Proper speed is between 6-7 Hz. The Vibrato Oscillator will not oscillate if adjustment is extreme.

L1 TUNING COIL
This adjustment is carefully set at the factory. Should tuning be necessary, it is suggested a tuning fork for a certain note be used (C for example). By holding down a key (C for example), adjust the tuning coil with a non-metalic screwdriver until no roll or beat is heard between the organ note and fork tone. When this note is properly tuned, the TOS tuning is automatically locked in.

SCHEMATIC 2

VR7 PEDAL WOW REST ADJUSTMENT
This adjustment should be set for 1.2 volts at Pin 14 of IC19A. Too extreme an adjustment will result in the loss of the Pedal Wow effect.

VR9 SYMPHONIC WOW ADJUSTMENT
This adjustment should be set for 1.2 volts at the cathode of D35. Too extreme an adjustment will result in the loss of the Symphonic Wow effect.

SCHEMATIC 6

VR15 GENIE THUMP ADJUSTMENT
The Genie length is factory-set by component values. The purpose of the Genie Thump Adjustment is to eliminate any DC transient (thump) that may occur when playing the Genie Accompaniment voices. To adjust, turn on any rhythm and a Genie accompaniment tabswitch (Piano, Guitar, Banjo) set rhythm volume at minimum and expression shoe at maximum. Turn adjustment until minimum thump is heard. If thump level cannot be reduced satisfactorily by adjustment, then replace Genie Modulator IC.

SCHEMATIC 17

VR25 CLOCK 1 SPEED ADJUSTMENT
This adjustment is set at the factory for 19Hz. Readjustment should only be necessary when circuit components are replaced. Extreme adjustment will result in the loss of chorus effect.

VR24 CLOCK 2 SPEED ADJUSTMENT
This adjustment is set at the factory for 2.2Hz. Readjustment should only be necessary when circuit components are replaced. Extreme adjustment will result in the loss of chorus effect.

VR26, VR27 AND VR28 PHASE 1, 2 AND 3 LEVEL ADJUSTMENT

These adjustments affect the volume of the Phase 1, 2 and 3 outputs. The output volume of each phase should be equal. The combined output of the three phases should equal the Flute volume with the chorus switch off.

SCHEMATIC 18

VR31 PERCUSSION CHORUS SPEED OSCILLATOR ADJUSTMENT
This adjustment regulates the frequency of the Chorus Speed Oscillator. The factory setting is .7Hz; too extreme an adjustment will result in the loss of chorus effect on the Percussion voices.

VR30 PERCUSSION BIAS ADJUSTMENT
This adjustment adjusts the bias voltage for the Bucket Brigade IC181. With Percussion voice on and a key held, turn VR30 in both directions until distortion occurs. Proper setting is the midpoint between the distortion regions.

SCHEMATIC 19

L6 CHORD TUNING COIL
First, tune L1 as described above. Then turn off the Magic Chord tab and all Rhythm tabs. Turn on only the Lower Keyboard String Bass voice and Upper Keyboard Kinura voice. Now, holding a C on both the Upper and Lower Keyboards, adjust tuning coil L6 until no roll or beat is heard between the two notes.
NOTE: When tuning, always make sure all vibrato and vibrato pre-set voices are off.

VR40 CHORD LEVEL ADJUSTMENT
With the Magic Chord tab off, hold a three-note left-hand chord; switch the Magic Chord tab on and hold the same chord, but as a Genie one-note chord. Adjust VR40 until the volume level of the chord is the same with the Magic Chord tab on or off.

ADJUSTMENTS

SCHEMATIC 21

VR45 SNARE NOISE ADJUSTMENT
VR47 CYMBAL ADJUSTMENT
VR48 BRUSH ADJUSTMENT

The best setting of these adjustments is one where the instruments sound balanced when compared to the drums. Always set these adjustments with the balance control at midpoint. Proper Snare Drum noise is achieved when the High and Low Drum sounds blend with the Snare noise producing the most realistic Snare Drum.

SCHEMATIC 26

VR54 CHORUS SPEED OSCILLATOR

This adjustment regulates the frequency of the Chorus Speed Oscillator. The factory setting is .7 Hz; too extreme an adjustment will result in the loss of chorus effect on the Orchestral Symphonizer presets.

VR53 BIAS ADJUSTMENT

This adjustment adjusts the bias voltage for the Bucket Brigade IC235. With an Orchestral Symphonizer preset on and a key held, turn VR53 in both directions until distortion occurs. Proper setting is the midpoint between the distortion regions.

SCHEMATIC 27

VR57 AOC RANGE ADJUSTMENT

This adjustment regulates the voltage supply to the AOC keyers, thereby adjusting the AOC range. Too extreme an adjustment will cause dissonant chords when playing AOC.

SCHEMATIC 29

VR64 MINIMUM ORGAN ADJUSTMENT

Set this adjustment by turning only the Flute 8 tab on. Hold down a key with the expression shoe at minimum expression and turn VR64 until the note being held can just be heard.

VR63 MAXIMUM ORGAN ADJUSTMENT

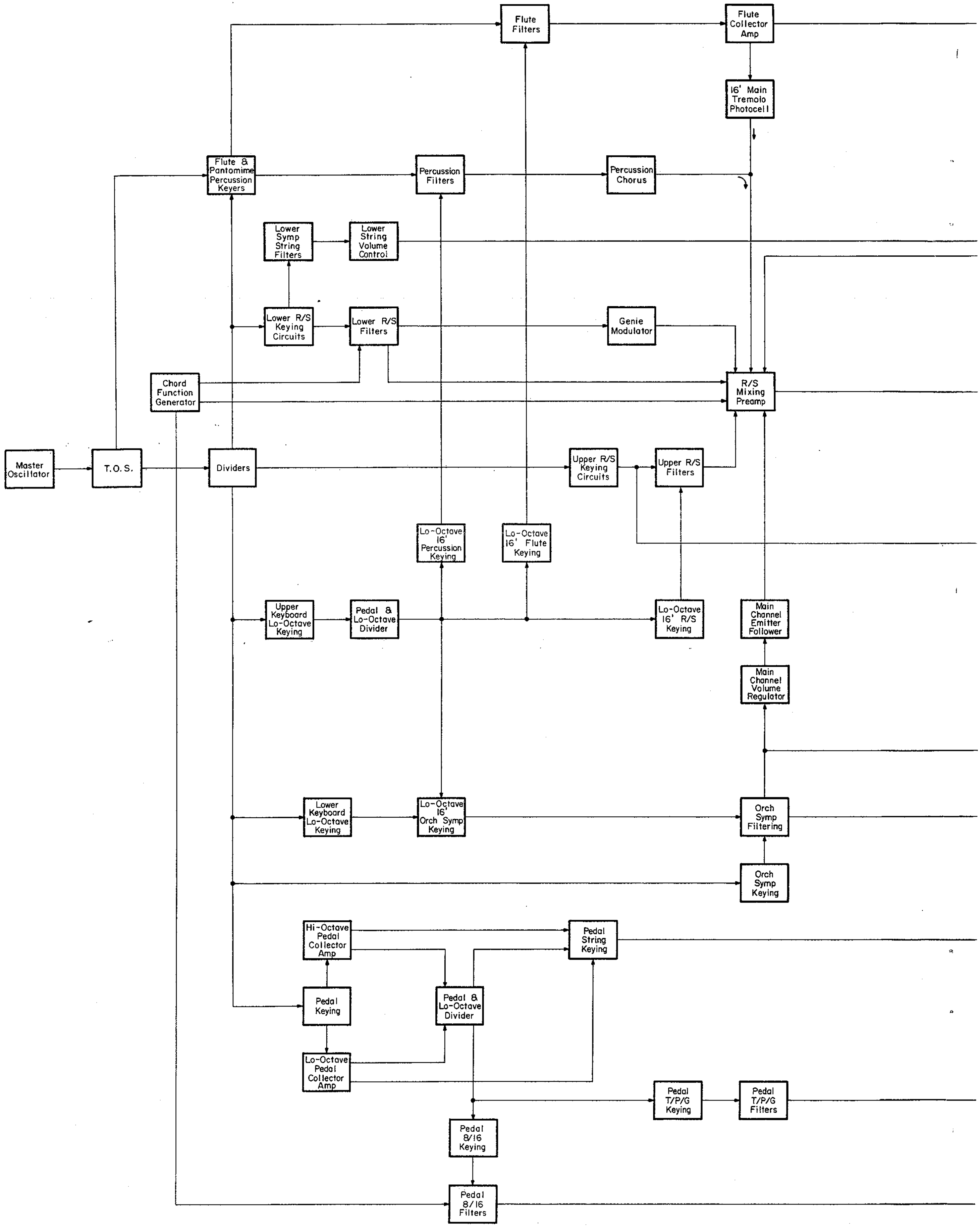
This adjustment is factory-set for maximum output at full expression shoe. Adjustment of VR63 effects only the maximum volume level of the organ and does not effect the minimum adjustment setting.

SCHEMATIC 30

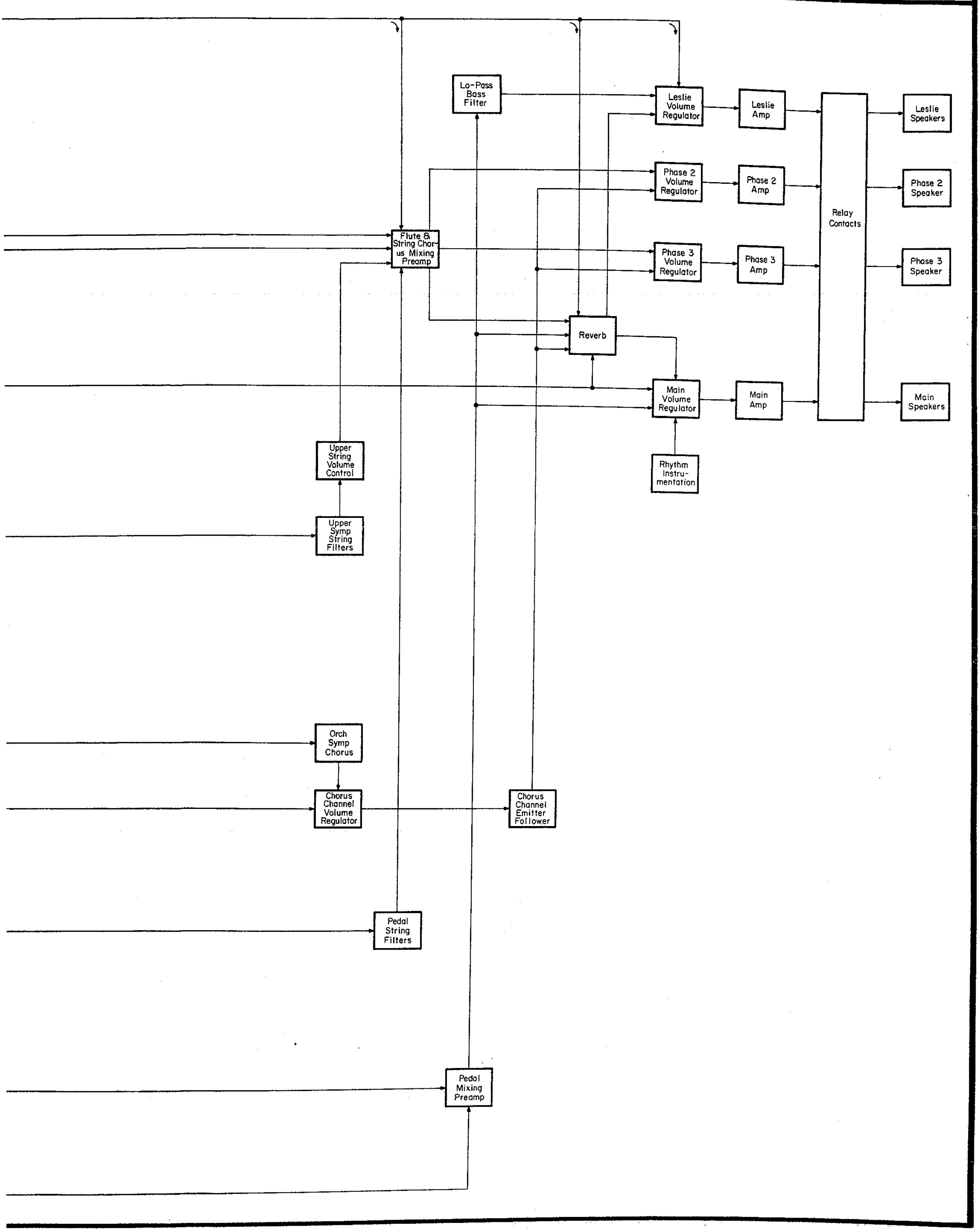
VR67 VOLTAGE ADJUSTMENT

VR67 adjusts the DC voltage outputted from IC263 and should be set for 14 volts at IC263 Pin 2.

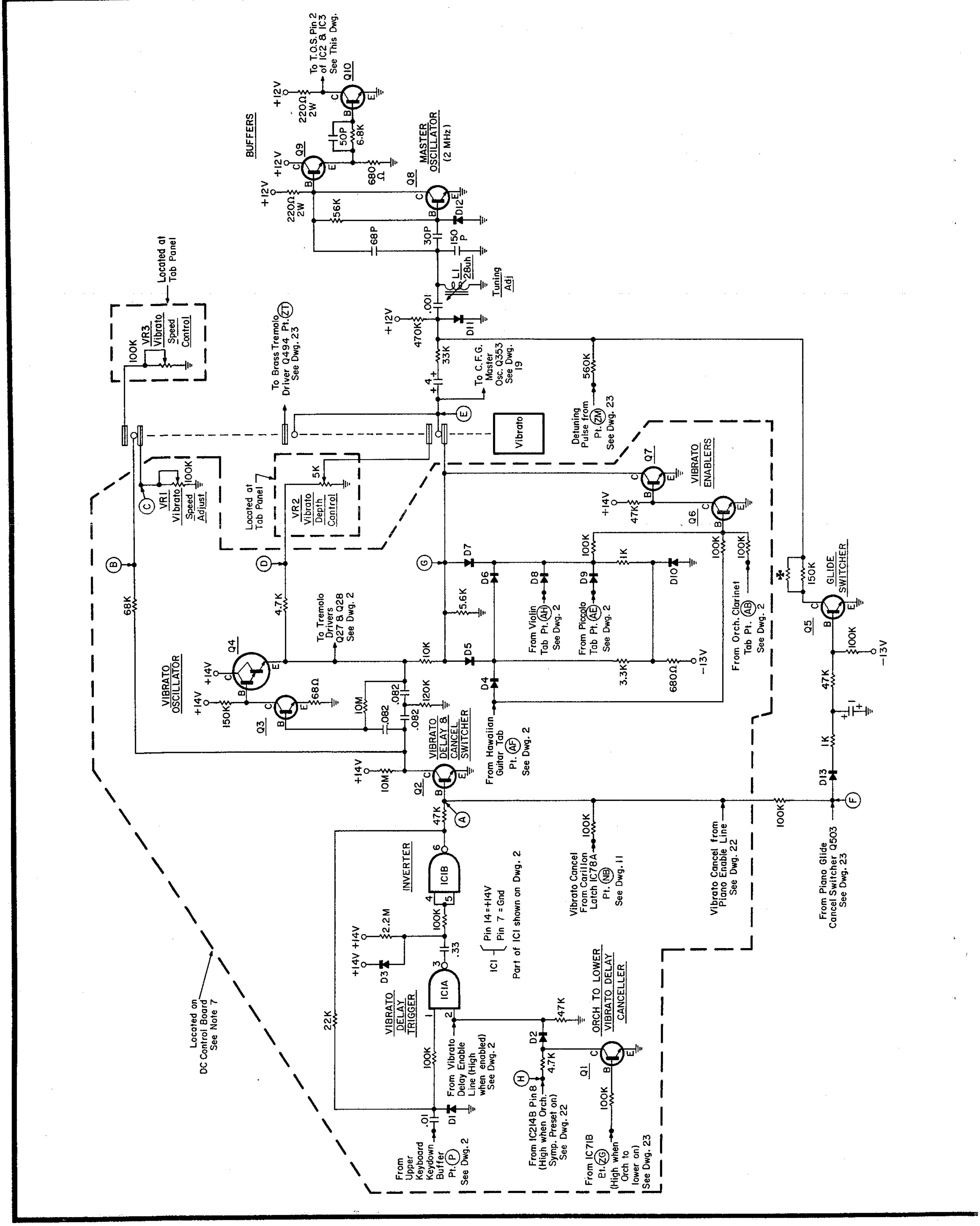
BLOCK DIAGRAM


Flute Filters
Flute Collector Amp
16' Main Tremolo Photocell
Flute & Pantomime Percussion Keyers
Percussion Filters
Percussion Chorus
Lower Symp String Filters
Lower String Volume Control
Lower R/S Keying Circuits
Lower R/S Filters
Genie Modulator
Chord Function Generator
R/S Mixing Preamp
Master Oscillator
T.O.S.
Dividers
Upper R/S Keying Circuits
Upper R/S Filters
Lo-Octave 16' Percussion Keying
Lo-Octave 16' Flute Keying
Upper Keyboard Lo-Octave Keying
Pedal & Lo-Octave Divider
Lo-Octave 16' R/S Keying
Main Channel Emitter Follower
Main Channel Volume Regulator
Lower Keyboard Lo-Octave Keying
Lo-Octave 16' Orch Symp Keying
Orch Symp Filtering
Orch Symp Keying
Hi-Octave Pedal Collector Amp
Pedal String Keying
Pedal Keying
Pedal & Lo-Octave Divider
Lo-Octave Pedal Collector Amp
Pedal T/P/G Keying
Pedal T/P/G Filters
Pedal 8/16 Keying
Pedal 8/16 Filters

BLOCK DIAGRAM


Lo-Pass Bass Filter
Leslie Volume Regulator
Leslie Amp
Relay Contacts
Leslie Speakers
Phase 2 Volume Regulator
Phase 2 Amp
Phase 2 Speaker
Flute & String Chorus Mixing Preamp
Phase 3 Volume Regulator
Phase 3 Amp
Phase 3 Speaker
Reverb
Main Volume Regulator
Main Amp
Main Speakers
Rhythm instru-mentation
Upper String Volume Control
Upper Symp String Filters
Orch Symp Chorus
Chorus Channel Volume Regulator
Chorus Channel Emitter Follower
Pedal String Filters
Pedal Mixing Preamp

SCHEMATIC 1


BUFFERS
Q9
Q10
+12V
220Ω 2W
To T.O.S. Pin 2 of IC2 & IC3 See This Dwg.
50P
6.8K
680 Ω
56K
MASTER OSCILLATOR (2 MHz)
Q8
D12
68P
30P
150 P
L1 28uh
Tuning Adj
.001
470K
D11
33K
+12V
To C.F.G. Master Osc. Q353 See Dwg. 19
4
Located at Tab Panel
VR3 Vibrato Speed Control
100K
To Brass Tremolo Driver Q494 Pt. ZT See Dwg. 23
Vibrato
560K
Detuning Pulse from Pt. ZM See Dwg. 23
E
VR1 Vibrato Speed Adjust
VR2 Vibrato Depth Control
5K
Located at Tab Panel
Q7
VIBRATO ENABLERS
Q6
+14V
47K
C
B
D
G
68K
4.7K
D7
D6
D8
D9
D10
100K
1K
5.6K
From Violin Tab Pt. AH See Dwg. 2
From Piccolo Tab Pt. AE See Dwg. 2
From Orch. Clarinet Tab Pt. AB See Dwg. 2
150K
GLIDE SWITCHER
Q5
To Tremolo Drivers Q27 & Q28 See Dwg. 2
VIBRATO OSCILLATOR
Q4
Q3
+14V
150K
68Ω
10K
D5
D4
3.3K
680Ω
-13V
10M
.082
120K
VIBRATO DELAY & CANCEL SWITCHER
Q2
From Hawaiian Guitar Tab Pt. AF See Dwg. 2
47K
1K
D13
A
F
100K
Vibrato Cancel From Carillon Latch IC78A Pt. NB See Dwg. 11
Vibrato Cancel from Piano Enable Line See Dwg. 22
From Piano Glide Cancel Switcher Q503 See Dwg. 23
INVERTER
IC1B
IC1 { Pin 14=+14V Pin 7 = Gnd
Part of IC1 shown on Dwg. 2
2.2M
.33
D3
IC1A
VIBRATO DELAY TRIGGER
22K
100K
.01
D1
From Vibrato Delay Enable Line (High when enabled) See Dwg. 2
From Upper Keyboard Keydown Buffer Pt. P See Dwg. 2
ORCH TO LOWER VIBRATO DELAY CANCELLER
Q1
D2
47K
4.7K
H
From IC214B Pin 8 (High when Orch. Symp. Preset on) See Dwg. 22
From IC71B Pt. ZG (High when Orch to lower on) See Dwg. 23
Located on DC Control Board See Note 7

SCHEMATIC I

NOTES:

1. All resistors are 10%, 1/2 watt or less unless otherwise specified.
2. All Capacitors are in microfarads unless otherwise specified.
3. All voltages measured to ground with a Simpson 260 VOM.
4. See Parts List for component part numbers.
5. All Keyswitches, Tabswitches and Pushbutton Switches shown in "off" position.
6. ✢ Denotes factory tailored component.
7. All components located on Tone Generator Board unless otherwise specified.

VIBRATO, TONE GENERATORS
& DIVIDERS

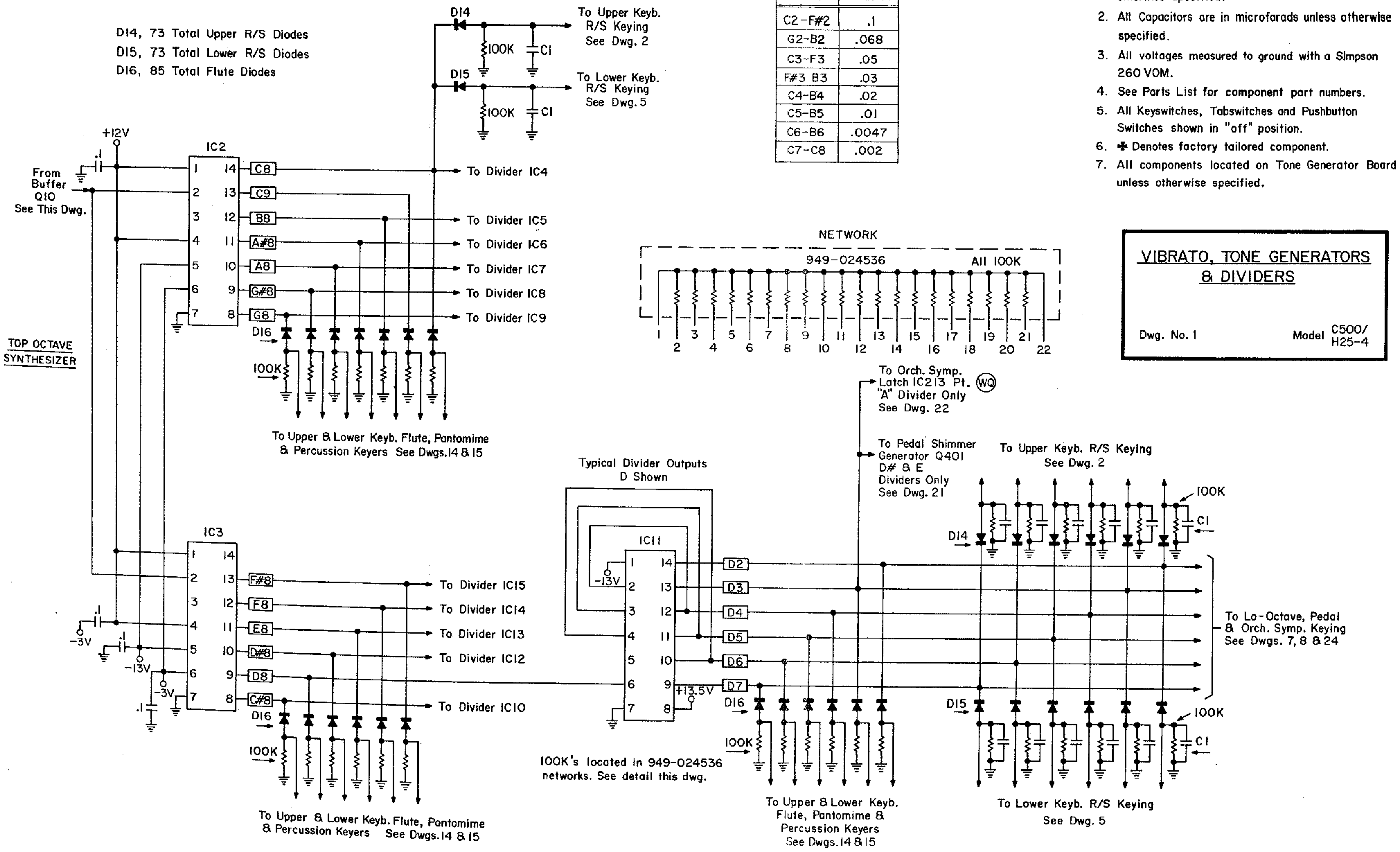
Dwg. No. 1

Model C500/ H25-4

Capacitor Value Chart

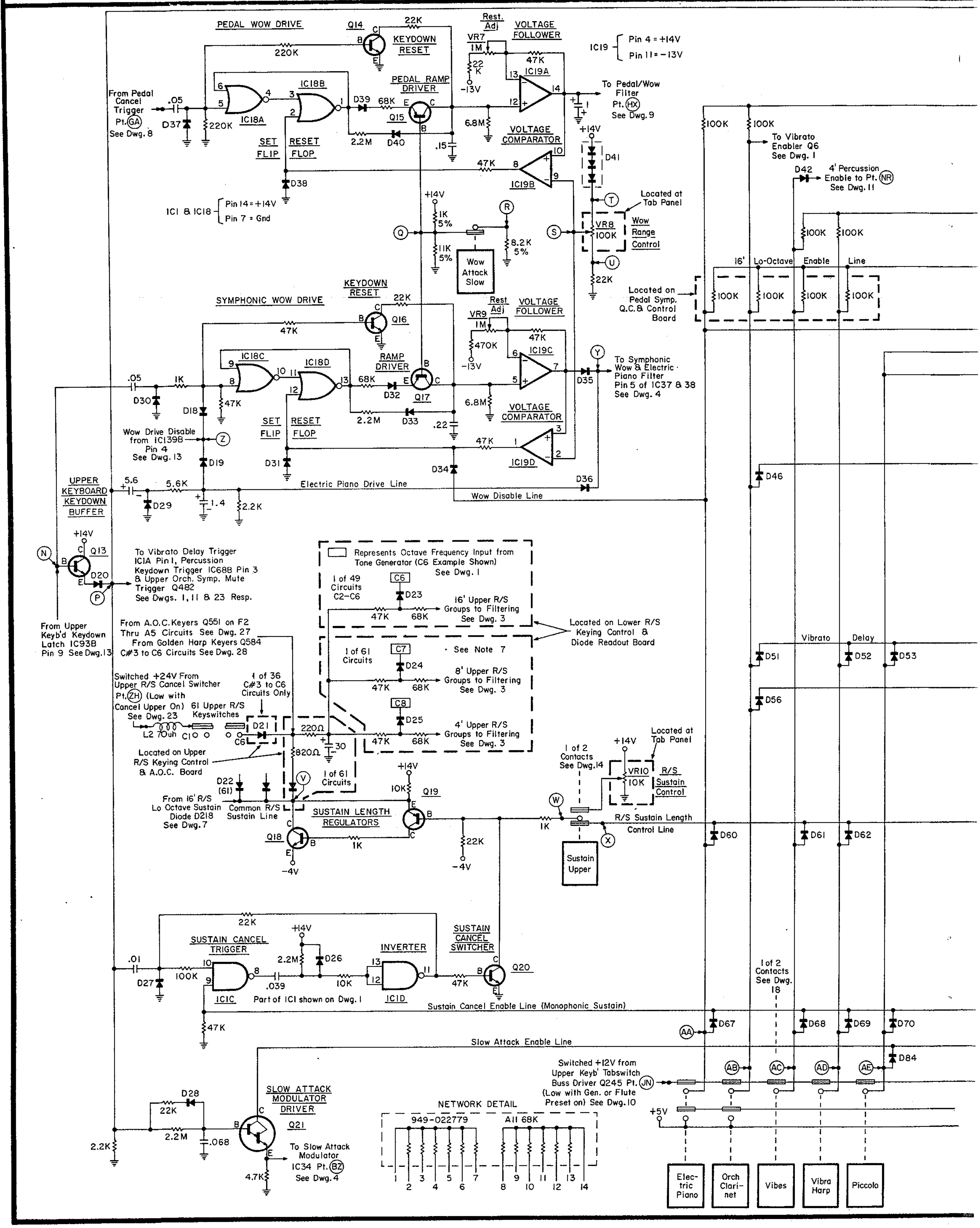
Octave	Value C1
C2-F#2	.1
G2-B2	.068
C3-F3	.05
F#3 B3	.03
C4-B4	.02
C5-B5	.01
C6-B6	.0047
C7-C8	.002

D14, 73 Total Upper R/S Diodes
D15, 73 Total Lower R/S Diodes
D16, 85 Total Flute Diodes



TOP OCTAVE SYNTHESIZER
+12V
From Buffer Q10 See This Dwg.
IC2
IC3
.1
-3V
-13V
C8
C9
B8
A#8
A8
G#8
G8
F#8
F8
E8
D#8
D8
C#8
D14
D15
D16
100K
C1
To Upper Keyb. R/S Keying See Dwg. 2
To Lower Keyb. R/S Keying See Dwg. 5
To Divider IC4
To Divider IC5
To Divider IC6
To Divider IC7
To Divider IC8
To Divider IC9
To Divider IC15
To Divider IC14
To Divider IC13
To Divider IC12
To Divider IC10
To Upper & Lower Keyb. Flute, Pantomime & Percussion Keyers See Dwgs.14 & 15
NETWORK
949-024536
All 100K
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
Typical Divider Outputs D Shown
IC11
+13.5V
D2
D3
D4
D5
D6
D7
100K's located in 949-024536 networks. See detail this dwg.
To Orch. Symp. Latch IC213 Pt. "A" Divider Only See Dwg. 22
WQ
To Pedal Shimmer Generator Q401 D# & E Dividers Only See Dwg. 21
To Upper Keyb. R/S Keying See Dwg. 2
To Lo-Octave, Pedal & Orch. Symp. Keying See Dwgs. 7, 8 & 24
To Upper & Lower Keyb. Flute, Pantomime & Percussion Keyers See Dwgs.14 & 15
To Lower Keyb. R/S Keying See Dwg. 5

SCHEMATIC 2

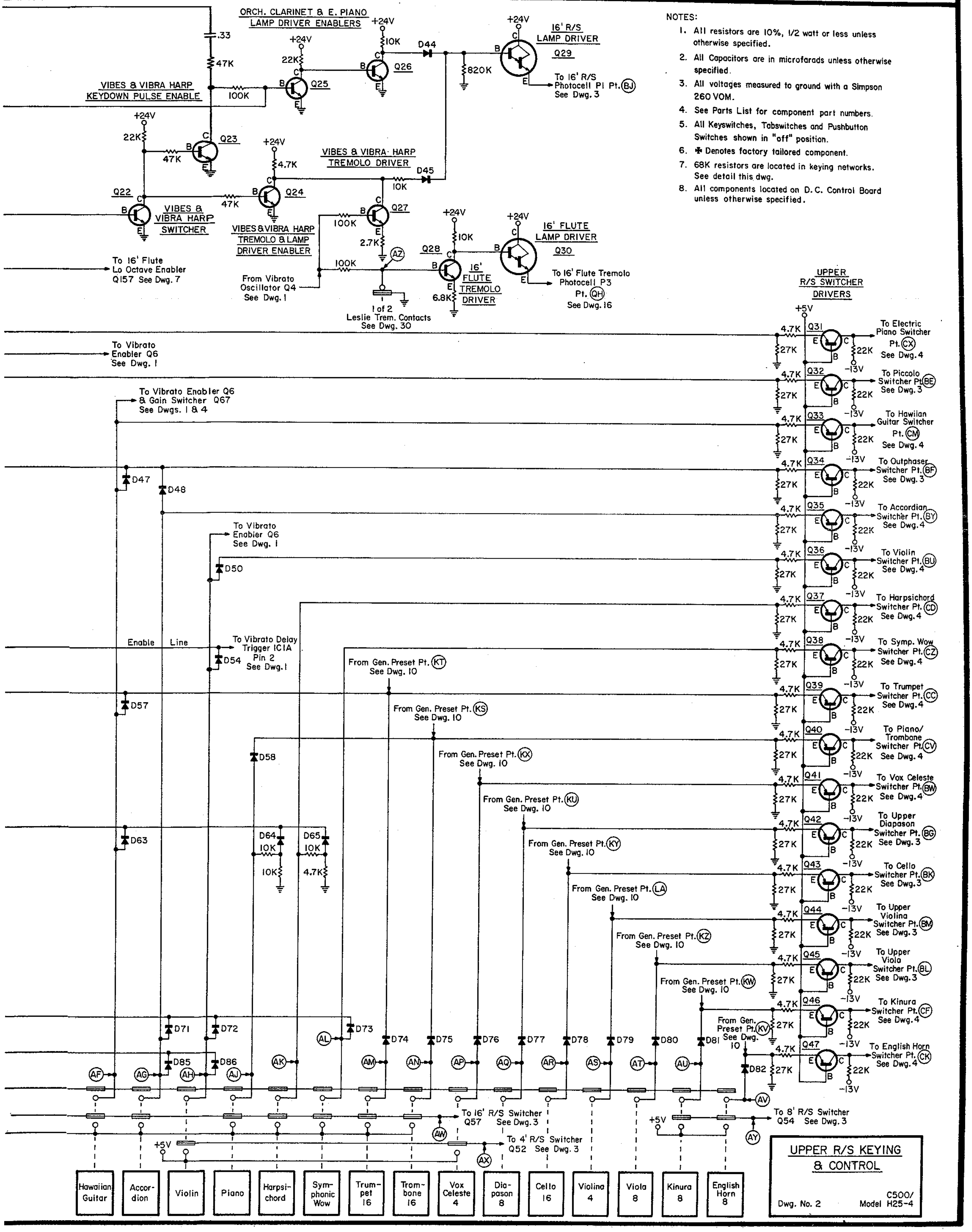


PEDAL WOW DRIVE
Q14
22K
KEYDOWN RESET
220K
Rest. Adj
VR7 1M
VOLTAGE FOLLOWER
22K
-13V
47K
IC19A
IC19 Pin 4 = +14V Pin 11 = -13V
IC18B
IC18A
PEDAL RAMP DRIVER
D39 68K
Q15
2.2M D40
.15
6.8M
To Pedal/Wow Filter Pt. (HX) See Dwg. 9
From Pedal Cancel Trigger Pt. (GA) See Dwg. 8
.05
D37
220K
SET FLIP
RESET FLOP
VOLTAGE COMPARATOR
47K
IC19B
+14V
D41
D38
IC1 & IC18 Pin 14 = +14V Pin 7 = Gnd
+14V
1K 5%
11K 5%
Wow Attack Slow
8.2K 5%
Q R S T U
VR8 100K
Wow Range Control
Located at Tab Panel
22K
100K
100K
To Vibrato Enabler Q6 See Dwg. 1
D42
4' Percussion Enable to Pt. (NR) See Dwg. 11
16' Lo-Octave Enable Line
Located on Pedal Symp. Q.C. & Control Board
KEYDOWN RESET
SYMPHONIC WOW DRIVE
22K
Q16
47K
Rest. Adj
VR9 1M
VOLTAGE FOLLOWER
470K
-13V
47K
IC19C
IC18C
IC18D
RAMP DRIVER
Q17
68K D32
2.2M D33
.22
6.8M
VOLTAGE COMPARATOR
47K
IC19D
D35
To Symphonic Wow & Electric Piano Filter Pin 5 of IC37 & 38 See Dwg. 4
.05 1K
D30
D18
47K
Wow Drive Disable from IC139B Pin 4 See Dwg. 13
(Z)
D19
D31
D34
D36
Electric Piano Drive Line
Wow Disable Line
UPPER KEYBOARD KEYDOWN BUFFER
5.6
5.6K
D29
1.4
2.2K
D46
+14V
Q13
D20
(N) (P)
To Vibrato Delay Trigger IC1A Pin 1, Percussion Keydown Trigger IC68B Pin 3 & Upper Orch. Symp. Mute Trigger Q482 See Dwgs. 1, 11 & 23 Resp.
From Upper Keyb'd Keydown Latch IC93B Pin 9 See Dwg. 13
Represents Octave Frequency Input from Tone Generator (C6 Example Shown) See Dwg. 1
1 of 49 Circuits C2–C6
C6 D23
47K 68K
16' Upper R/S Groups to Filtering See Dwg. 3
Located on Lower R/S Keying Control & Diode Readout Board
From A.O.C. Keyers Q551 on F2 Thru A5 Circuits See Dwg. 27 From Golden Harp Keyers Q584 C#3 to C6 Circuits See Dwg. 28
1 of 61 Circuits
C7 D24
See Note 7
8' Upper R/S Groups to Filtering See Dwg. 3
47K 68K
Vibrato Delay
D51 D52 D53
D56
Switched +24V From Upper R/S Cancel Switcher Pt. (ZH) (Low with Cancel Upper On) See Dwg. 23
61 Upper R/S Keyswitches
1 of 36 C#3 to C6 Circuits Only
L2 70uh C10
C6
D21
220Ω
30
820Ω
C8 D25
47K 68K
4' Upper R/S Groups to Filtering See Dwg. 3
Located on Upper R/S Keying Control & A.O.C. Board
D22 (61)
1 of 61 Circuits
(V)
From 16' R/S Lo Octave Sustain Diode D218 See Dwg. 7
Common R/S Sustain Line
Q18
-4V
1K
SUSTAIN LENGTH REGULATORS
+14V
10K
Q19
22K
-4V
1K
(W)
1 of 2 Contacts See Dwg. 14
+14V
VR10 10K
R/S Sustain Control
Located at Tab Panel
R/S Sustain Length Control Line
(X)
Sustain Upper
D60 D61 D62
22K
SUSTAIN CANCEL TRIGGER
+14V
2.2M
D26
INVERTER
SUSTAIN CANCEL SWITCHER
.01
D27
100K
IC1C
.039
10K
IC1D
47K
Q20
Part of IC1 shown on Dwg. 1
Sustain Cancel Enable Line (Monophonic Sustain)
47K
1 of 2 Contacts See Dwg. 18
(AA)
D67 D68 D69 D70
Slow Attack Enable Line
D84
D28
22K
2.2M
.068
2.2K
SLOW ATTACK MODULATOR DRIVER
Q21
To Slow Attack Modulator IC34 Pt. (BZ) See Dwg. 4
4.7K
NETWORK DETAIL
949-022779
All 68K
1 2 3 4 5 6 7 8 9 10 11 12 13 14
Switched +12V from Upper Keyb' Tabswitch Buss Driver Q245 Pt. (JN) (Low with Gen. or Flute Preset on) See Dwg. 10
(AB) (AC) (AD) (AE)
+5V
Electric Piano
Orch Clarinet
Vibes
Vibra Harp
Piccolo

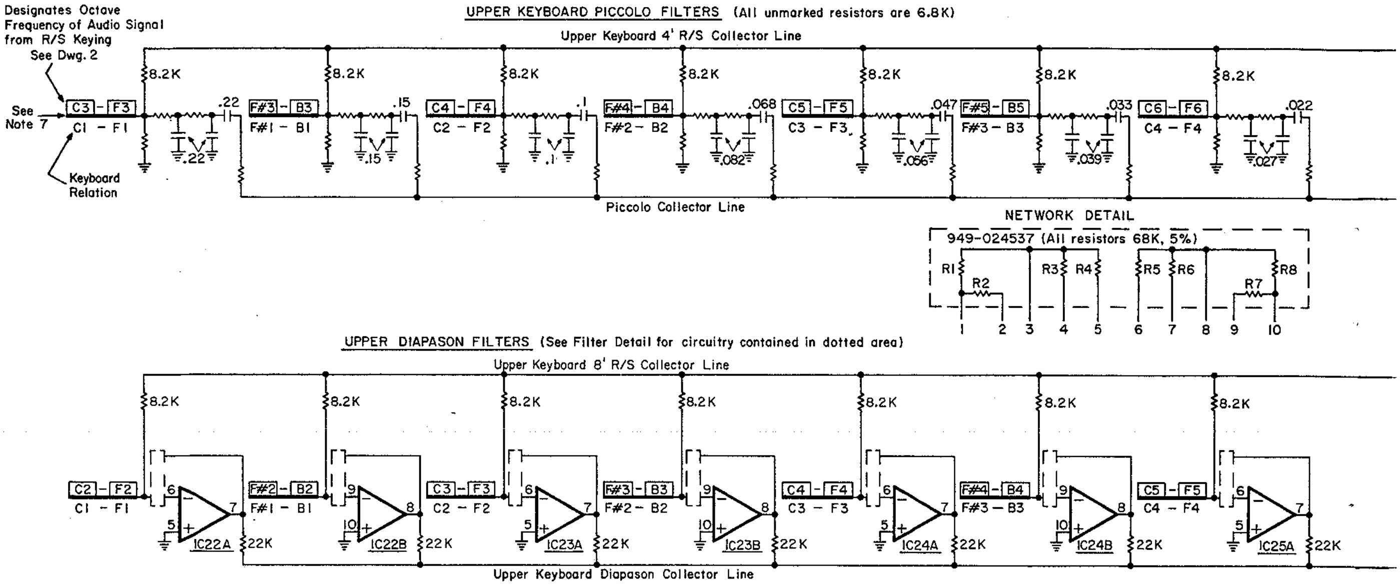
SCHEMATIC 2

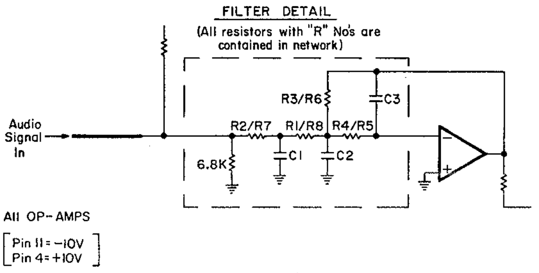
NOTES:

1. All resistors are 10%, 1/2 watt or less unless otherwise specified.
2. All Capacitors are in microfarads unless otherwise specified.
3. All voltages measured to ground with a Simpson 260 VOM.
4. See Parts List for component part numbers.
5. All Keyswitches, Tabswitches and Pushbutton Switches shown in "off" position.
6. ✚ Denotes factory tailored component.
7. 68K resistors are located in keying networks. See detail this dwg.
8. All components located on D.C. Control Board unless otherwise specified.


ORCH. CLARINET & E. PIANO LAMP DRIVER ENABLERS
.33
47K
22K
+24V
10K
Q25
Q26
D44
820K
16' R/S LAMP DRIVER
Q29
To 16' R/S Photocell P1 Pt. BJ See Dwg. 3
VIBES & VIBRA HARP KEYDOWN PULSE ENABLE
100K
Q23
Q22
VIBES & VIBRA HARP SWITCHER
4.7K
Q24
VIBES & VIBRA HARP TREMOLO DRIVER
D45
VIBES & VIBRA HARP TREMOLO & LAMP DRIVER ENABLER
Q27
2.7K
AZ
Q28
16' FLUTE TREMOLO DRIVER
6.8K
16' FLUTE LAMP DRIVER
Q30
To 16' Flute Tremolo Photocell P3 Pt. QH See Dwg. 16
To 16' Flute Lo Octave Enabler Q157 See Dwg. 7
From Vibrato Oscillator Q4 See Dwg. 1
1 of 2 Leslie Trem. Contacts See Dwg. 30
UPPER R/S SWITCHER DRIVERS
+5V
Q31
To Electric Piano Switcher Pt. CX See Dwg. 4
Q32
To Piccolo Switcher Pt. BE See Dwg. 3
Q33
To Hawiian Guitar Switcher Pt. CM See Dwg. 4
Q34
To Outphaser Switcher Pt. BF See Dwg. 3
Q35
To Accordian Switcher Pt. BY See Dwg. 4
Q36
To Violin Switcher Pt. BU See Dwg. 4
Q37
To Harpsichord Switcher Pt. CD See Dwg. 4
Q38
To Symp. Wow Switcher Pt. CZ See Dwg. 4
Q39
To Trumpet Switcher Pt. CC See Dwg. 4
Q40
To Piano/ Trombone Switcher Pt. CV See Dwg. 4
Q41
To Vox Celeste Switcher Pt. BW See Dwg. 4
Q42
To Upper Diapason Switcher Pt. BG See Dwg. 3
Q43
To Cello Switcher Pt. BK See Dwg. 3
Q44
To Upper Violina Switcher Pt. BM See Dwg. 3
Q45
To Upper Viola Switcher Pt. BL See Dwg. 3
Q46
To Kinura Switcher Pt. CF See Dwg. 4
Q47
To English Horn Switcher Pt. CK See Dwg. 4
4.7K
27K
22K
-13V
E
B
C
To Vibrato Enabler Q6 See Dwg. 1
To Vibrato Enabler Q6 & Gain Switcher Q67 See Dwgs. 1 & 4
D47
D48
To Vibrato Enabler Q6 See Dwg. 1
D50
Enable Line
To Vibrato Delay Trigger IC1A Pin 2 See Dwg. 1
D54
D57
From Gen. Preset Pt. KT See Dwg. 10
From Gen. Preset Pt. KS See Dwg. 10
D58
From Gen. Preset Pt. KX See Dwg. 10
From Gen. Preset Pt. KU See Dwg. 10
D63
D64
D65
10K
4.7K
From Gen. Preset Pt. KY See Dwg. 10
From Gen. Preset Pt. LA See Dwg. 10
From Gen. Preset Pt. KZ See Dwg. 10
From Gen. Preset Pt. KW See Dwg. 10
From Gen. Preset Pt. KV See Dwg. 10
D71
D72
D73
D74
D75
D76
D77
D78
D79
D80
D81
D82
D85
D86
AF
AG
AH
AJ
AK
AL
AM
AN
AP
AQ
AR
AS
AT
AU
AV
To 16' R/S Switcher Q57 See Dwg. 3
AW
To 4' R/S Switcher Q52 See Dwg. 3
AX
To 8' R/S Switcher Q54 See Dwg. 3
AY
Hawaiian Guitar
Accordion
Violin
Piano
Harpsichord
Symphonic Wow
Trumpet 16
Trombone 16
Vox Celeste 4
Diapason 8
Cello 16
Violina 4
Viola 8
Kinura 8
English Horn 8
UPPER R/S KEYING & CONTROL
Dwg. No. 2
C500/ Model H25-4

SCHEMATIC 3

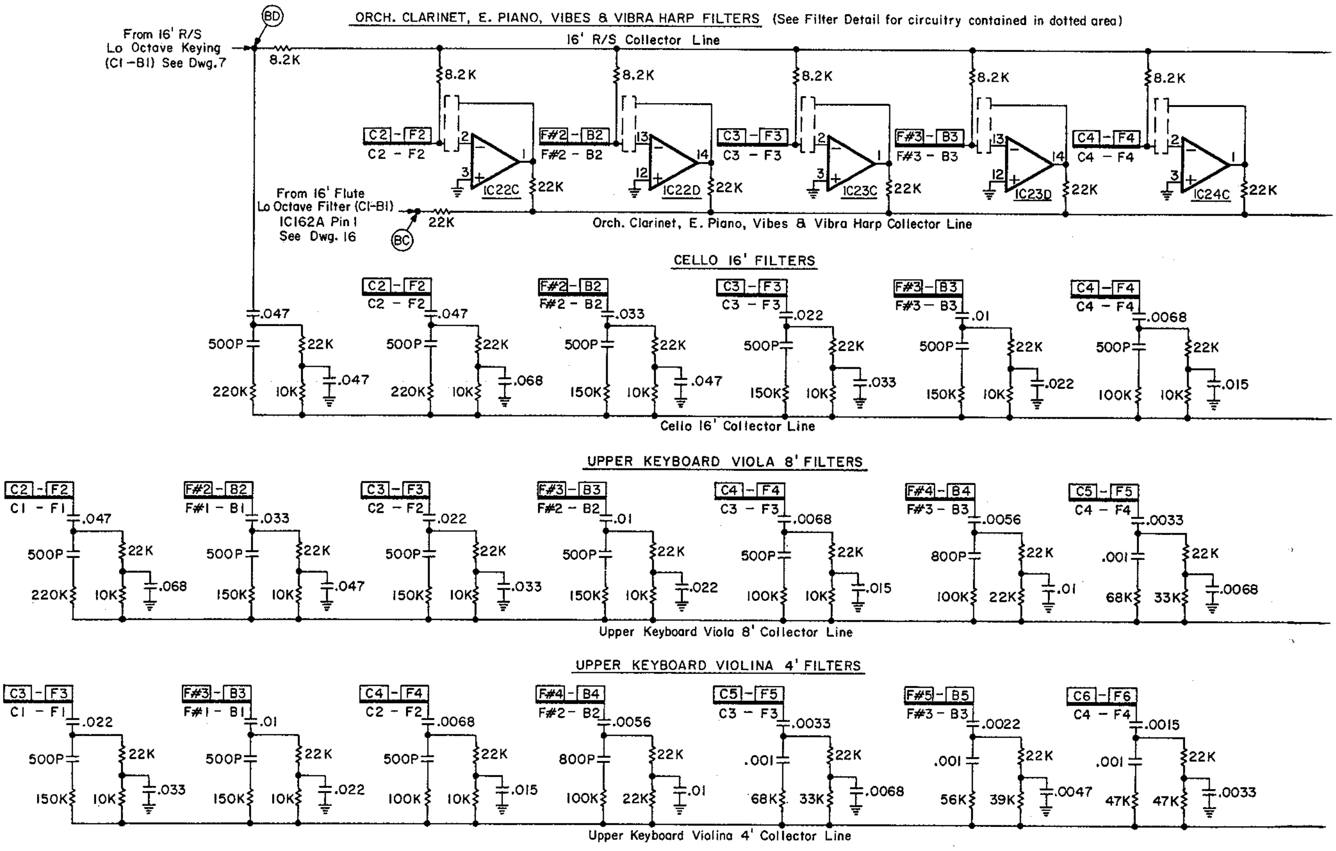

Designates Octave Frequency of Audio Signal from R/S Keying See Dwg. 2
See Note 7
Keyboard Relation
UPPER KEYBOARD PICCOLO FILTERS (All unmarked resistors are 6.8K)
Upper Keyboard 4' R/S Collector Line
8.2K
C3 - F3
C1 - F1
.22
F#3 - B3
F#1 - B1
.15
C4 - F4
C2 - F2
.1
F#4 - B4
F#2 - B2
.068
C5 - F5
C3 - F3
.047
F#5 - B5
F#3 - B3
.033
C6 - F6
C4 - F4
.022
.082
.056
.039
.027
Piccolo Collector Line
NETWORK DETAIL
949-024537 (All resistors 68K, 5%)
R1
R2
R3
R4
R5
R6
R7
R8
1 2 3 4 5 6 7 8 9 10
UPPER DIAPASON FILTERS (See Filter Detail for circuitry contained in dotted area)
Upper Keyboard 8' R/S Collector Line
C2 - F2
C1 - F1
IC22A
F#2 - B2
F#1 - B1
IC22B
C3 - F3
C2 - F2
IC23A
F#3 - B3
F#2 - B2
IC23B
C4 - F4
C3 - F3
IC24A
F#4 - B4
F#3 - B3
IC24B
C5 - F5
C4 - F4
IC25A
22K
Upper Keyboard Diapason Collector Line


FILTER DETAIL
(All resistors with "R" No's are contained in network)
Audio Signal In
R3/R6
C3
R2/R7
R1/R8
R4/R5
C1
C2
6.8K
All OP-AMPS
Pin 11 = -10V
Pin 4 = +10V

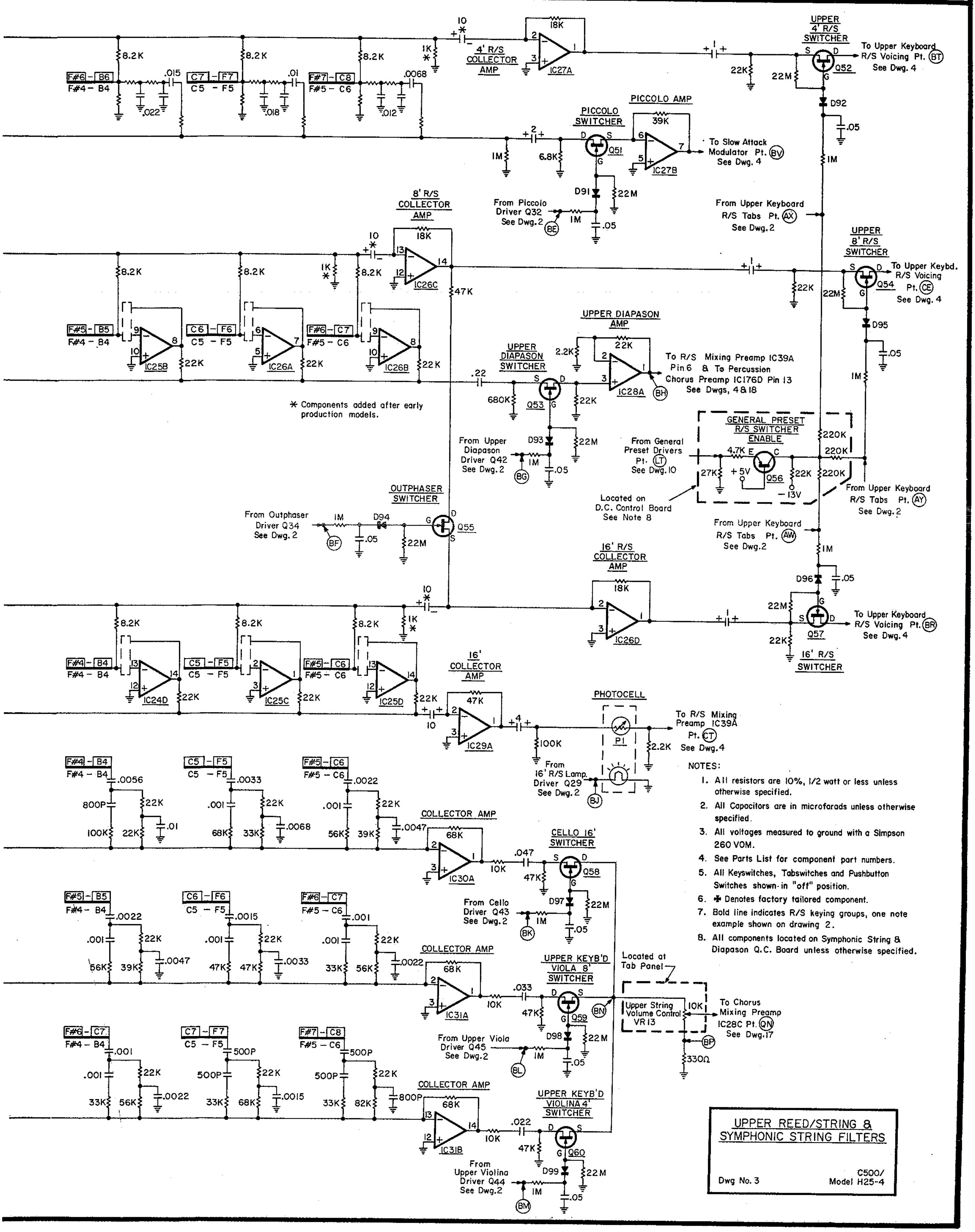
CAPACITOR VALUE CHART

Filter I.C. No.	C1	C2	C3
IC22 A	.056	.075	.0022
IC22 B	.039	.056	.0015
IC22 C	.12	.15	.0047
IC22 D	.075	.1	.0033
IC23 A	.027	.039	.001
IC23B	.02	.027	750P
IC23C	.056	.075	.0022
IC23D	.039	.056	.0015
IC24A	.014	.02	560P

Filter I.C. No.	C1	C2	C3
IC24B	.01	.014	390P
IC24C	.027	.039	.001
IC24D	.02	.027	750P
IC25A	.0068	.01	270P
IC25B	.0047	.068	200P
IC25C	.014	.02	560P
IC25D	.01	.014	390P
IC26A	.0033	.0047	130P
IC26B	.0024	.0033	82P


ORCH. CLARINET, E. PIANO, VIBES & VIBRA HARP FILTERS (See Filter Detail for circuitry contained in dotted area)
From 16' R/S Lo Octave Keying (C1-B1) See Dwg.7
BD
16' R/S Collector Line
8.2K
C2 - F2
IC22C
F#2 - B2
IC22D
C3 - F3
IC23C
F#3 - B3
IC23D
C4 - F4
IC24C
22K
From 16' Flute Lo Octave Filter (C1-B1) IC162A Pin 1 See Dwg. 16
BC
Orch. Clarinet, E. Piano, Vibes & Vibra Harp Collector Line
CELLO 16' FILTERS
Cello 16' Collector Line
UPPER KEYBOARD VIOLA 8' FILTERS
Upper Keyboard Viola 8' Collector Line
UPPER KEYBOARD VIOLINA 4' FILTERS
Upper Keyboard Violina 4' Collector Line
500P
800P
.001
220K
150K
100K
68K
56K
47K
10K
33K
39K
.047
.068
.033
.022
.01
.0068
.015
.0056
.0033
.0022
.0047
.0015

SCHEMATIC 3


4' R/S COLLECTOR AMP
IC27A
18K
UPPER 4' R/S SWITCHER
Q52
To Upper Keyboard R/S Voicing Pt. (BT) See Dwg. 4
D92
PICCOLO SWITCHER
Q51
PICCOLO AMP
IC27B
39K
To Slow Attack Modulator Pt. (BV) See Dwg. 4
From Piccolo Driver Q32 See Dwg. 2 (BE)
D91
From Upper Keyboard R/S Tabs Pt. (AX) See Dwg. 2
8' R/S COLLECTOR AMP
IC26C
UPPER 8' R/S SWITCHER
Q54
To Upper Keybd. R/S Voicing Pt. (CE) See Dwg. 4
D95
F#6 - B6
F#4 - B4
C7 - F7
C5 - F5
F#7 - C8
F#5 - C6
F#5 - B5
C6 - F6
F#6 - C7
IC25B
IC26A
IC26B
UPPER DIAPASON AMP
IC28A
UPPER DIAPASON SWITCHER
Q53
To R/S Mixing Preamp IC39A Pin 6 & To Percussion Chorus Preamp IC176D Pin 13 See Dwgs, 4 & 18 (BH)
* Components added after early production models.
From Upper Diapason Driver Q42 See Dwg. 2 (BG)
D93
GENERAL PRESET R/S SWITCHER ENABLE
Q56
From General Preset Drivers Pt. (LT) See Dwg. 10
+5V
-13V
Located on D.C. Control Board See Note 8
From Upper Keyboard R/S Tabs Pt. (AY) See Dwg. 2
OUTPHASER SWITCHER
Q55
From Outphaser Driver Q34 See Dwg. 2 (BF)
D94
From Upper Keyboard R/S Tabs Pt. (AW) See Dwg. 2
16' R/S COLLECTOR AMP
IC26D
D96
Q57
To Upper Keyboard R/S Voicing Pt. (BR) See Dwg. 4
16' R/S SWITCHER
F#4 - B4
C5 - F5
F#5 - C6
IC24D
IC25C
IC25D
16' COLLECTOR AMP
IC29A
47K
PHOTOCELL
P1
To R/S Mixing Preamp IC39A Pt. (CT) See Dwg. 4
From 16' R/S Lamp Driver Q29 See Dwg. 2 (BJ)
COLLECTOR AMP
IC30A
CELLO 16' SWITCHER
Q58
From Cello Driver Q43 See Dwg. 2 (BK)
D97
COLLECTOR AMP
IC31A
UPPER KEYB'D VIOLA 8' SWITCHER
Q59
From Upper Viola Driver Q45 See Dwg. 2 (BL)
D98
(BN)
Located at Tab Panel
Upper String Volume Control VR13
10K
To Chorus Mixing Preamp IC28C Pt. (QN) See Dwg. 17
(BP)
330Ω
COLLECTOR AMP
IC31B
UPPER KEYB'D VIOLINA 4' SWITCHER
Q60
From Upper Violina Driver Q44 See Dwg. 2 (BM)
D99
8.2K
22K
22M
1M
.05
10
1K
.015
.022
.01
.018
.0068
.012
.22
680K
2.2K
100K
.0056
.0033
.0022
800P
.001
.0047
.0015
500P
68K
39K
33K
56K
82K
.047
.033
.022
27K
4.7K
220K

NOTES:

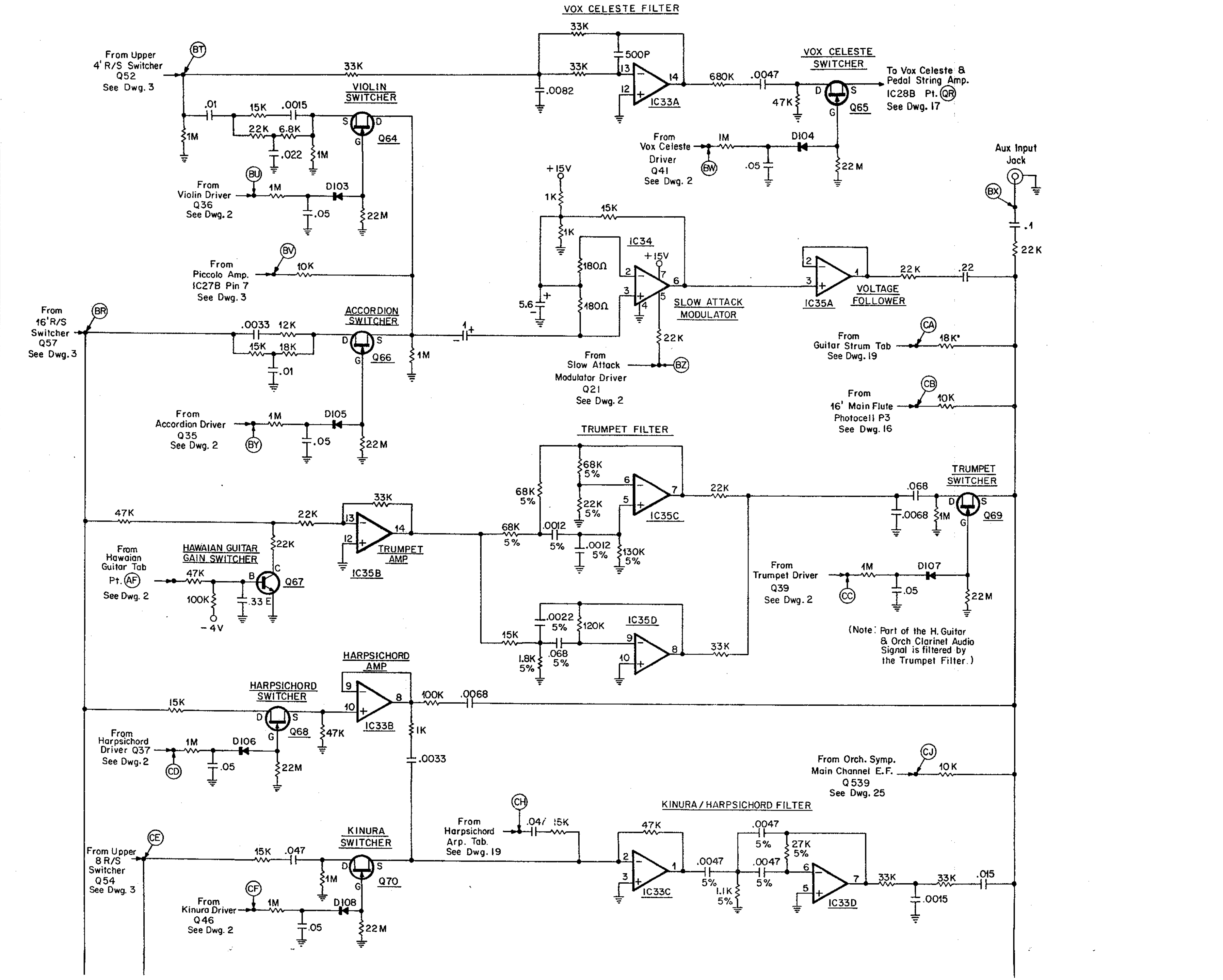
1. All resistors are 10%, 1/2 watt or less unless otherwise specified.
2. All Capacitors are in microfarads unless otherwise specified.
3. All voltages measured to ground with a Simpson 260 VOM.
4. See Parts List for component part numbers.
5. All Keyswitches, Tabswitches and Pushbutton Switches shown in "off" position.
6. ✱ Denotes factory tailored component.
7. Bold line indicates R/S keying groups, one note example shown on drawing 2.
8. All components located on Symphonic String & Diapason Q.C. Board unless otherwise specified.

UPPER REED/STRING & SYMPHONIC STRING FILTERS

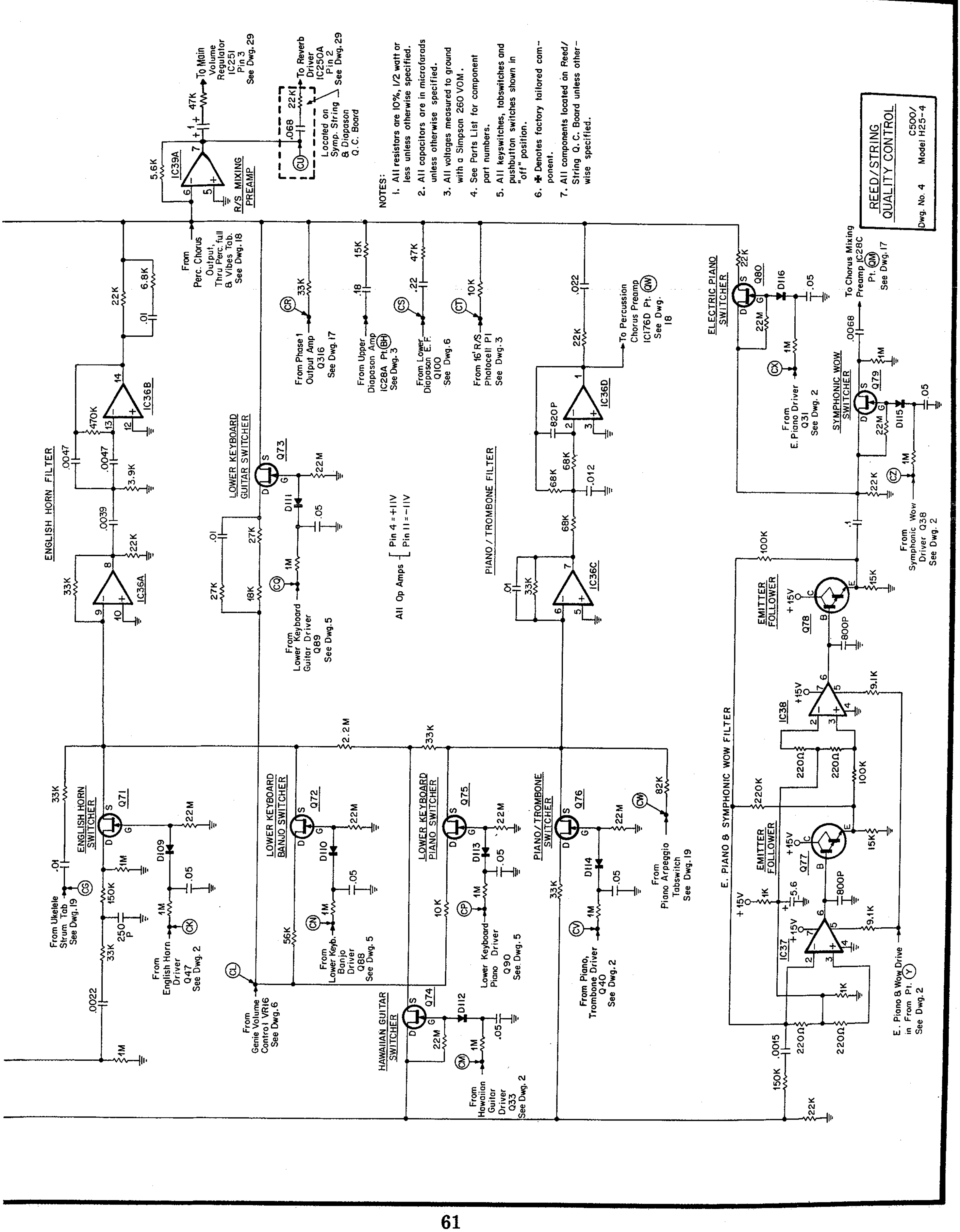
Dwg No. 3

C500/
Model H25-4

SCHEMATIC 4


VOX CELESTE FILTER
VOX CELESTE SWITCHER
To Vox Celeste & Pedal String Amp. IC28B Pt. QR See Dwg. 17
From Upper 4' R/S Switcher Q52 See Dwg. 3
BT
VIOLIN SWITCHER
Q64
IC33A
Q65
D104
From Vox Celeste Driver Q41 See Dwg. 2
BW
Aux Input Jack
BX
From Violin Driver Q36 See Dwg. 2
BU
D103
From Piccolo Amp. IC27B Pin 7 See Dwg. 3
BV
+15V
IC34
SLOW ATTACK MODULATOR
IC35A
VOLTAGE FOLLOWER
From 16'R/S Switcher Q57 See Dwg. 3
BR
ACCORDION SWITCHER
Q66
From Slow Attack Modulator Driver Q21 See Dwg. 2
BZ
From Guitar Strum Tab See Dwg. 19
CA
From 16' Main Flute Photocell P3 See Dwg. 16
CB
From Accordion Driver Q35 See Dwg. 2
BY
D105
TRUMPET FILTER
IC35C
TRUMPET SWITCHER
Q69
TRUMPET AMP
IC35B
HAWAIIAN GUITAR GAIN SWITCHER
From Hawaiian Guitar Tab Pt. AF See Dwg. 2
Q67
-4V
From Trumpet Driver Q39 See Dwg. 2
CC
D107
IC35D
(Note: Part of the H. Guitar & Orch Clarinet Audio Signal is filtered by the Trumpet Filter.)
HARPSICHORD AMP
HARPSICHORD SWITCHER
Q68
IC33B
From Harpsichord Driver Q37 See Dwg. 2
CD
D106
From Orch. Symp. Main Channel E.F. Q539 See Dwg. 25
CJ
KINURA/HARPSICHORD FILTER
CH
From Harpsichord Arp. Tab. See Dwg. 19
From Upper 8 R/S Switcher Q54 See Dwg. 3
CE
KINURA SWITCHER
Q70
IC33C
IC33D
From Kinura Driver Q46 See Dwg. 2
CF
D108

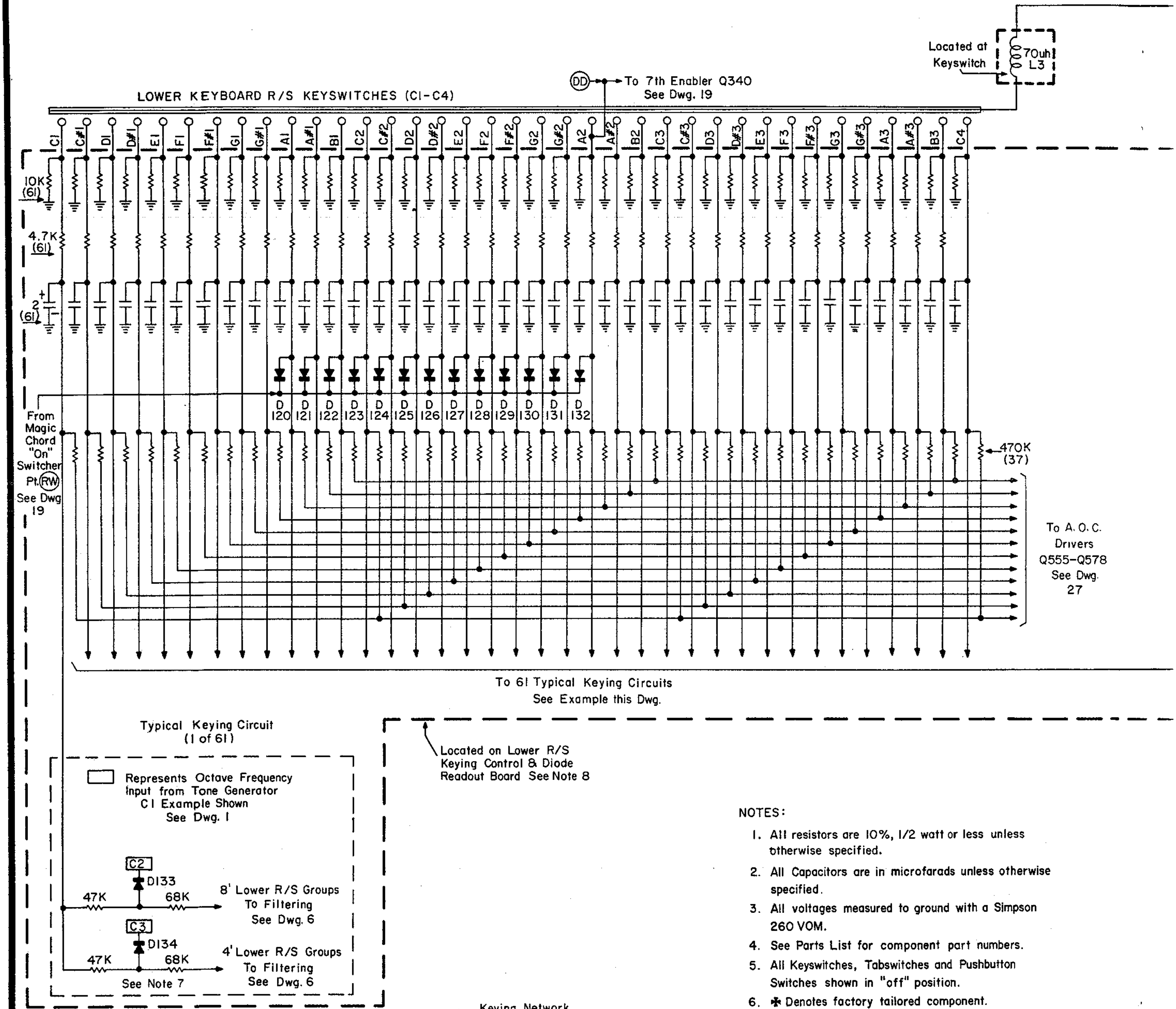
SCHEMATIC 4


ENGLISH HORN FILTER
IC36A
IC36B
IC39A
R/S MIXING PREAMP
To Main Volume Regulator IC251 Pin 3 See Dwg. 29
To Reverb Driver IC250A Pin 2 See Dwg. 29
Located on Symp. String & Diapason Q.C. Board
From Perc. Chorus Output, Thru Perc. full & Vibes Tab. See Dwg. 18
LOWER KEYBOARD GUITAR SWITCHER
Q73
From Lower Keyboard Guitar Driver Q89 See Dwg. 5
From Phase 1 Output Amp Q316 See Dwg. 17
From Upper Diapason Amp IC28A Pt. BH See Dwg. 3
From Lower Diapason E.F. Q100 See Dwg. 6
From 16' R/S Photocell P1 See Dwg. 3
All Op Amps Pin 4 = +11V Pin 11 = -11V
PIANO / TROMBONE FILTER
IC36C
IC36D
To Percussion Chorus Preamp IC176D Pt. QW See Dwg. 18
ELECTRIC PIANO SWITCHER
Q80
D116
From E. Piano Driver Q31 See Dwg. 2
To Chorus Mixing Preamp IC28C Pt. QM See Dwg. 17
SYMPHONIC WOW SWITCHER
Q79
D115
From Symphonic Wow Driver Q38 See Dwg. 2
EMITTER FOLLOWER
Q78
Q77
IC38
IC37
E. PIANO & SYMPHONIC WOW FILTER
E. Piano & Wow Drive in From Pt. Y See Dwg. 2
ENGLISH HORN SWITCHER
Q71
D109
From Ukelele Strum Tab See Dwg. 19
From English Horn Driver Q47 See Dwg. 2
LOWER KEYBOARD BANJO SWITCHER
Q72
D110
From Lower Keyb. Banjo Driver Q88 See Dwg. 5
From Genie Volume Control VR16 See Dwg. 6
LOWER KEYBOARD PIANO SWITCHER
Q75
D113
Lower Keyboard Piano Driver Q90 See Dwg. 5
HAWAIIAN GUITAR SWITCHER
Q74
D112
From Hawaiian Guitar Driver Q33 See Dwg. 2
PIANO / TROMBONE SWITCHER
Q76
D114
From Piano, Trombone Driver Q40 See Dwg. 2
From Piano Arpeggio Tabswitch See Dwg. 19
CG
CK
CL
CN
CP
CM
CV
CW
CQ
CR
CS
CT
CU
CX
CZ

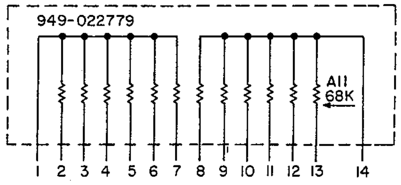
NOTES:
1. All resistors are 10%, 1/2 watt or less unless otherwise specified.
2. All capacitors are in microfarads unless otherwise specified.
3. All voltages measured to ground with a Simpson 260 VOM.
4. See Parts List for component part numbers.
5. All keyswitches, tabswitches and pushbutton switches shown in "off" position.
6. ✱ Denotes factory tailored component.
7. All components located on Reed/String Q. C. Board unless otherwise specified.

REED/STRING
QUALITY CONTROL
Dwg. No. 4
C500/
Model H25-4

SCHEMATIC 5


LOWER KEYBOARD R/S KEYSWITCHES (C1-C4)
DD
To 7th Enabler Q340
See Dwg. 19
Located at Keyswitch
70uh
L3
C1
C#1
D1
D#1
E1
F1
F#1
G1
G#1
A1
A#1
B1
C2
C#2
D2
D#2
E2
F2
F#2
G2
G#2
A2
A#2
B2
C3
C#3
D3
D#3
E3
F3
F#3
G3
G#3
A3
A#3
B3
C4
10K (61)
4.7K (61)
+
2 (61)
D 120
D 121
D 122
D 123
D 124
D 125
D 126
D 127
D 128
D 129
D 130
D 131
D 132
From Magic Chord "On" Switcher Pt. RW See Dwg 19
470K (37)
To A.O.C. Drivers Q555-Q578 See Dwg. 27
To 61 Typical Keying Circuits
See Example this Dwg.
Located on Lower R/S Keying Control & Diode Readout Board See Note 8
Typical Keying Circuit (1 of 61)
Represents Octave Frequency Input from Tone Generator C1 Example Shown See Dwg. 1
C2
D133
47K
68K
8' Lower R/S Groups To Filtering See Dwg. 6
C3
D134
47K
68K
4' Lower R/S Groups To Filtering See Dwg. 6
See Note 7

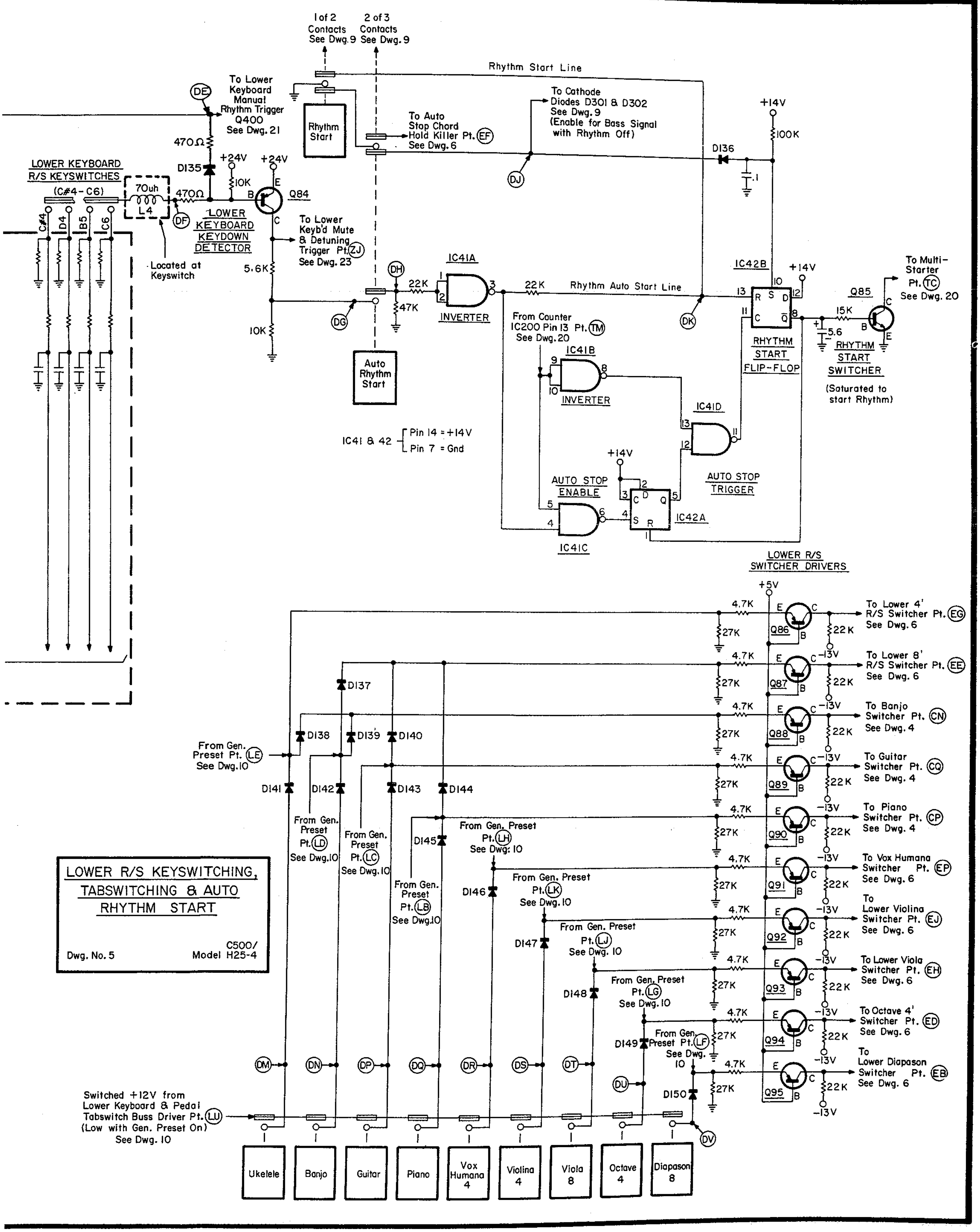
Keying Network


949-022779
All 68K
1
2
3
4
5
6
7
8
9
10
11
12
13
14

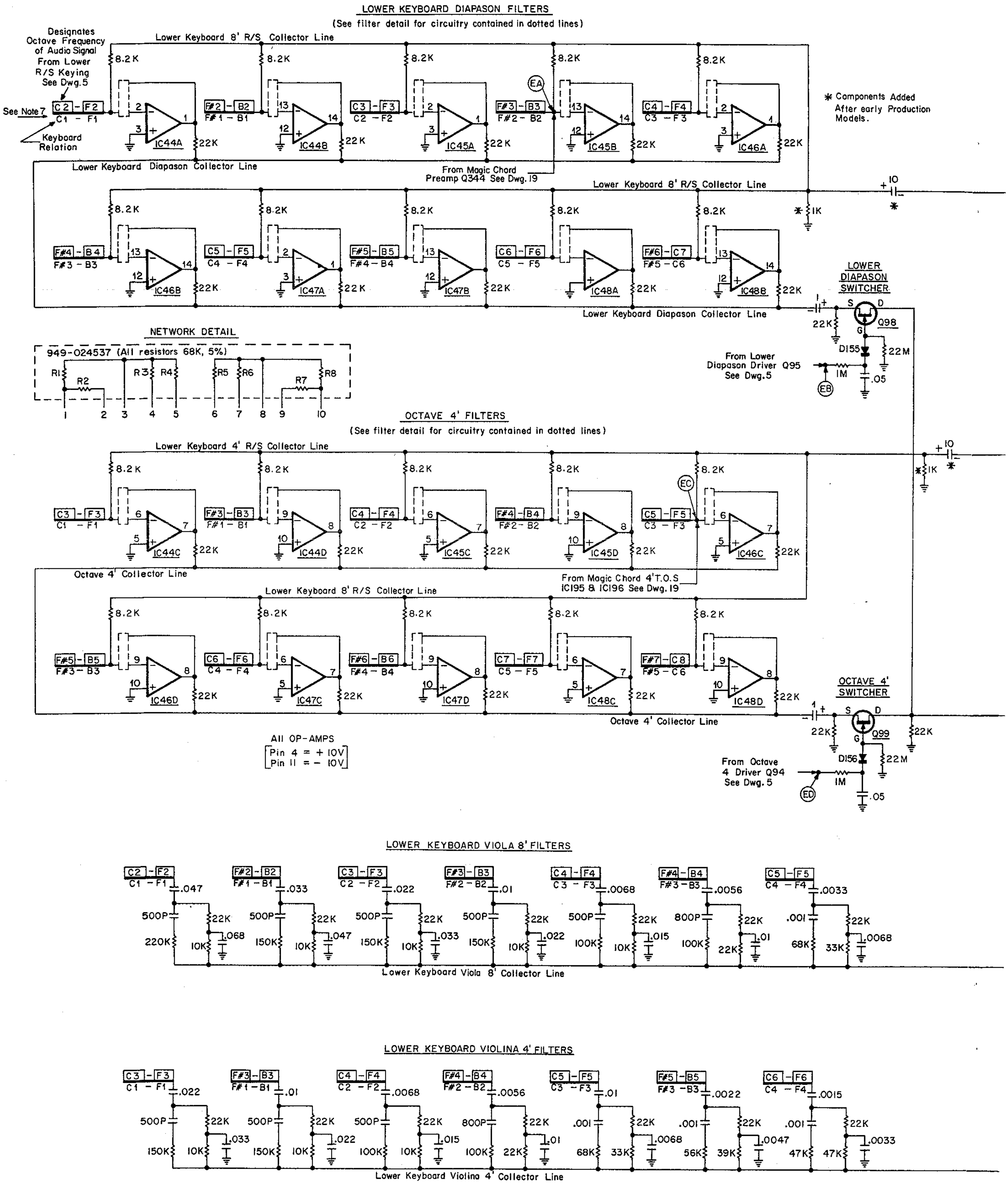
NOTES:

1. All resistors are 10%, 1/2 watt or less unless otherwise specified.
2. All Capacitors are in microfarads unless otherwise specified.
3. All voltages measured to ground with a Simpson 260 VOM.
4. See Parts List for component part numbers.
5. All Keyswitches, Tabswitches and Pushbutton Switches shown in "off" position.
6. ✱ Denotes factory tailored component.
7. 68 K Resistors are located in Keying Networks See Detail this Dwg.
8. All Components located on D. C. Control Board unless otherwise specified.

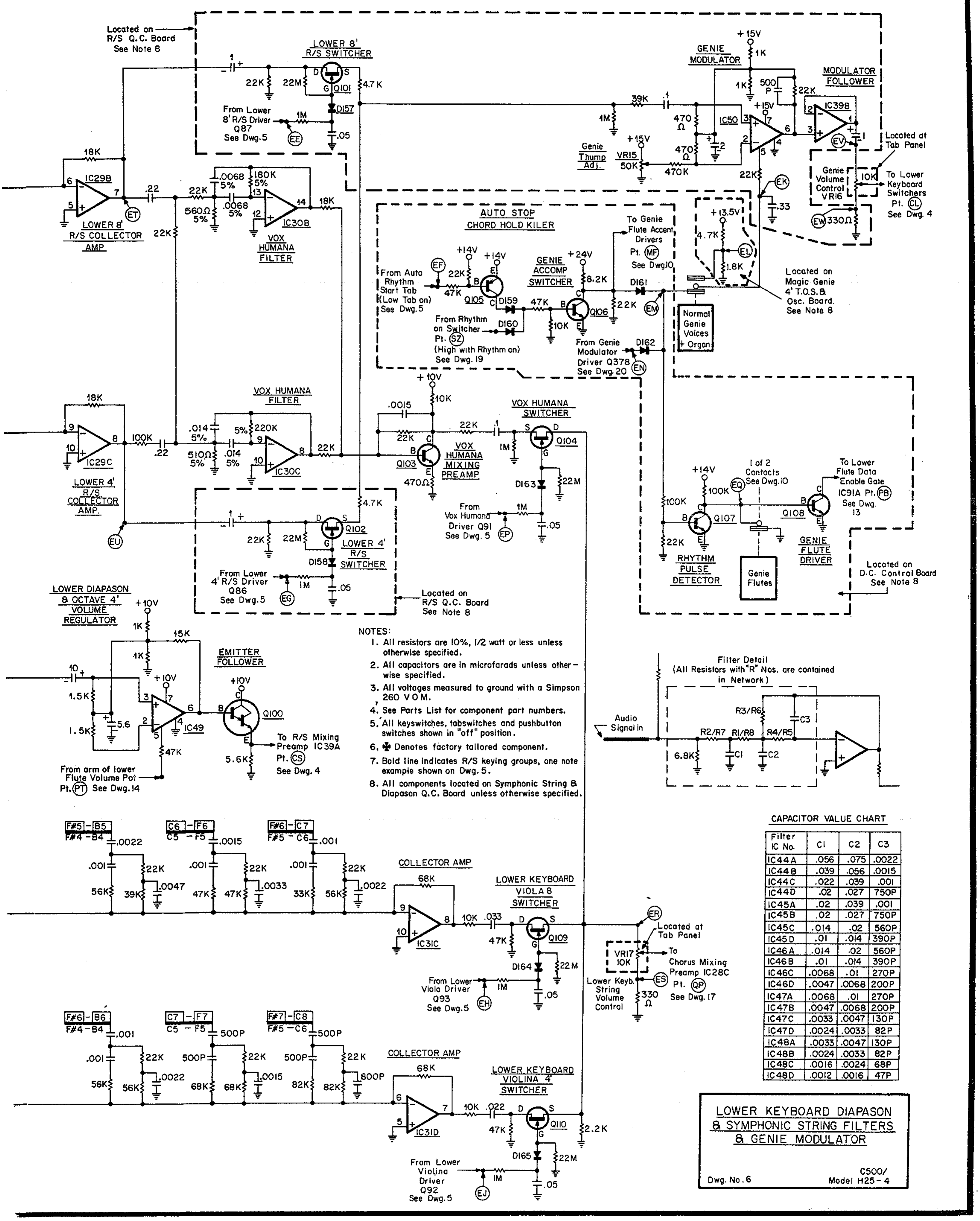
SCHEMATIC 5


1 of 2 Contacts See Dwg. 9
2 of 3 Contacts See Dwg. 9
Rhythm Start Line
Rhythm Start
To Lower Keyboard Manual Rhythm Trigger Q400 See Dwg. 21
DE
470Ω
D135
+24V
+24V
10K
470Ω
B
E
C
Q84
DF
LOWER KEYBOARD KEYDOWN DETECTOR
LOWER KEYBOARD R/S KEYSWITCHES (C#4 - C6)
C#4
D4
B5
C6
70uh
L4
Located at Keyswitch
5.6K
10K
To Lower Keyb'd Mute & Detuning Trigger Pt. ZJ See Dwg. 23
To Auto Stop Chord Hold Killer Pt. EF See Dwg. 6
To Cathode Diodes D301 & D302 See Dwg. 9 (Enable for Bass Signal with Rhythm Off)
DJ
D136
.1
+14V
100K
DH
DG
22K
47K
Auto Rhythm Start
IC41A
INVERTER
22K
Rhythm Auto Start Line
DK
IC42B
+14V
R S D
C Q̄
RHYTHM START FLIP-FLOP
15K
5.6
Q85
RHYTHM START SWITCHER
(Saturated to start Rhythm)
To Multi-Starter Pt. TC See Dwg. 20
From Counter IC200 Pin 13 Pt. TM See Dwg. 20
IC41B
INVERTER
IC41D
IC41 & 42 Pin 14 = +14V Pin 7 = Gnd
+14V
AUTO STOP ENABLE
AUTO STOP TRIGGER
IC42A
IC41C
LOWER R/S SWITCHER DRIVERS
+5V
4.7K
27K
22K
-13V
Q86
Q87
Q88
Q89
Q90
Q91
Q92
Q93
Q94
Q95
To Lower 4' R/S Switcher Pt. EG See Dwg. 6
To Lower 8' R/S Switcher Pt. EE See Dwg. 6
To Banjo Switcher Pt. CN See Dwg. 4
To Guitar Switcher Pt. CQ See Dwg. 4
To Piano Switcher Pt. CP See Dwg. 4
To Vox Humana Switcher Pt. EP See Dwg. 6
To Lower Violina Switcher Pt. EJ See Dwg. 6
To Lower Viola Pt. EH See Dwg. 6
To Octave 4' Switcher Pt. ED See Dwg. 6
To Lower Diapason Switcher Pt. EB See Dwg. 6
D137
D138
D139
D140
D141
D142
D143
D144
D145
D146
D147
D148
D149
D150
From Gen. Preset Pt. LE See Dwg. 10
From Gen. Preset Pt. LD See Dwg. 10
From Gen. Preset Pt. LC See Dwg. 10
From Gen. Preset Pt. LB See Dwg. 10
From Gen. Preset Pt. LH See Dwg. 10
From Gen. Preset Pt. LK See Dwg. 10
From Gen. Preset Pt. LJ See Dwg. 10
From Gen. Preset Pt. LG See Dwg. 10
From Gen. Preset Pt. LF See Dwg. 10
DM
DN
DP
DQ
DR
DS
DT
DU
DV
Switched +12V from Lower Keyboard & Pedal Tabswitch Buss Driver Pt. LU (Low with Gen. Preset On) See Dwg. 10
Ukelele
Banjo
Guitar
Piano
Vox Humana 4
Violina 4
Viola 8
Octave 4
Diapason 8
LOWER R/S KEYSWITCHING, TABSWITCHING & AUTO RHYTHM START
Dwg. No. 5
C500/ Model H25-4

SCHEMATIC 6


LOWER KEYBOARD DIAPASON FILTERS
(See filter detail for circuitry contained in dotted lines)
Designates Octave Frequency of Audio Signal From Lower R/S Keying See Dwg.5
See Note 7
Keyboard Relation
Lower Keyboard 8' R/S Collector Line
Lower Keyboard Diapason Collector Line
From Magic Chord Preamp Q344 See Dwg. 19
C2 - F2
C1 - F1
F#2 - B2
F#1 - B1
C3 - F3
C2 - F2
F#3 - B3
F#2 - B2
C4 - F4
C3 - F3
F#4 - B4
F#3 - B3
C5 - F5
C4 - F4
F#5 - B5
F#4 - B4
C6 - F6
C5 - F5
F#6 - C7
F#5 - C6
IC44A
IC44B
IC45A
IC45B
IC46A
IC46B
IC47A
IC47B
IC48A
IC48B
8.2K
22K
1K
10
EA
* Components Added After early Production Models.
LOWER DIAPASON SWITCHER
Q98
D155
22M
1M
.05
From Lower Diapason Driver Q95 See Dwg.5
EB
NETWORK DETAIL
949-024537 (All resistors 68K, 5%)
R1
R2
R3
R4
R5
R6
R7
R8
1 2 3 4 5 6 7 8 9 10
OCTAVE 4' FILTERS
(See filter detail for circuitry contained in dotted lines)
Lower Keyboard 4' R/S Collector Line
Octave 4' Collector Line
From Magic Chord 4' T.O.S IC195 & IC196 See Dwg. 19
EC
C3 - F3
C1 - F1
F#3 - B3
F#1 - B1
C4 - F4
C2 - F2
F#4 - B4
F#2 - B2
C5 - F5
C3 - F3
F#5 - B5
F#3 - B3
C6 - F6
C4 - F4
F#6 - B6
F#4 - B4
C7 - F7
C5 - F5
F#7 - C8
F#5 - C6
IC44C
IC44D
IC45C
IC45D
IC46C
IC46D
IC47C
IC47D
IC48C
IC48D
OCTAVE 4' SWITCHER
Q99
D156
From Octave 4 Driver Q94 See Dwg. 5
ED
All OP-AMPS
Pin 4 = + 10V
Pin 11 = - 10V
LOWER KEYBOARD VIOLA 8' FILTERS
C2 - F2 C1 - F1 .047 500P 220K 22K 10K .068
F#2 - B2 F#1 - B1 .033 500P 150K 22K 10K .047
C3 - F3 C2 - F2 .022 500P 150K 22K 10K .033
F#3 - B3 F#2 - B2 .01 500P 150K 22K 10K .022
C4 - F4 C3 - F3 .0068 500P 100K 22K 10K .015
F#4 - B4 F#3 - B3 .0056 800P 100K 22K 22K .01
C5 - F5 C4 - F4 .0033 .001 68K 22K 33K .0068
Lower Keyboard Viola 8' Collector Line
LOWER KEYBOARD VIOLINA 4' FILTERS
C3 - F3 C1 - F1 .022 500P 150K 22K 10K .033
F#3 - B3 F#1 - B1 .01 500P 150K 22K 10K .022
C4 - F4 C2 - F2 .0068 500P 100K 22K 10K .015
F#4 - B4 F#2 - B2 .0056 800P 100K 22K 22K .01
C5 - F5 C3 - F3 .01 .001 68K 22K 33K .0068
F#5 - B5 F#3 - B3 .0022 .001 56K 22K 39K .0047
C6 - F6 C4 - F4 .0015 .001 47K 22K 47K .0033
Lower Keyboard Violina 4' Collector Line

SCHEMATIC 6


Located on R/S Q.C. Board See Note 8
LOWER 8' R/S SWITCHER
Q101
D157
4.7K
22K
22M
From Lower 8' R/S Driver Q87 See Dwg.5
EE
1M
.05
18K
IC29B
LOWER 8' R/S COLLECTOR AMP
ET
.22
22K
560Ω 5%
.0068 5%
180K 5%
IC30B
VOX HUMANA FILTER
GENIE MODULATOR
+15V
1K
500P
22K
39K
1M
470Ω
IC50
2
22K
EK
.33
Genie Thump Adj.
VR15 50K
470K
MODULATOR FOLLOWER
IC39B
EV
Located at Tab Panel
Genie Volume Control VR16
10K
To Lower Keyboard Switchers Pt. CL See Dwg. 4
EW 330Ω
AUTO STOP CHORD HOLD KILER
From Auto Rhythm Start Tab (Low Tab on) See Dwg. 5
EF
+14V
Q105
D159
D160
From Rhythm on Switcher Pt. SZ (High with Rhythm on) See Dwg. 19
GENIE ACCOMP SWITCHER
+24V
8.2K
Q106
10K
To Genie Flute Accent Drivers Pt. MF See Dwg.10
D161
EM
From Genie Modulator Driver Q378 See Dwg. 20
D162
EN
+13.5V
4.7K
1.8K
EL
Normal Genie Voices + Organ
Located on Magic Genie 4' T.O.S. & Osc. Board. See Note 8
VOX HUMANA FILTER
IC29C
LOWER 4' R/S COLLECTOR AMP
100K
.014 5%
220K
510Ω 5%
IC30C
EU
+10V
.0015
VOX HUMANA MIXING PREAMP
Q103
470Ω
VOX HUMANA SWITCHER
Q104
D163
From Vox Humana Driver Q91 See Dwg. 5
EP
LOWER 4' R/S SWITCHER
Q102
D158
From Lower 4' R/S Driver Q86 See Dwg.5
EG
Located on R/S Q.C. Board See Note 8
RHYTHM PULSE DETECTOR
Q107
EQ
1 of 2 Contacts See Dwg.10
Q108
To Lower Flute Data Enable Gate IC91A Pt. PB See Dwg. 13
GENIE FLUTE DRIVER
Genie Flutes
Located on D.C. Control Board See Note 8
LOWER DIAPASON & OCTAVE 4' VOLUME REGULATOR
15K
1.5K
5.6
IC49
47K
EMITTER FOLLOWER
Q100
5.6K
To R/S Mixing Preamp IC39A Pt. CS See Dwg. 4
From arm of lower Flute Volume Pot Pt. PT See Dwg.14
Filter Detail (All Resistors with "R" Nos. are contained in Network)
Audio Signal in
R2/R7
R1/R8
R4/R5
R3/R6
C1
C2
C3
6.8K
F#5 - B5
F#4 - B4
C6 - F6
C5 - F5
F#6 - C7
F#5 - C6
COLLECTOR AMP
68K
IC31C
LOWER KEYBOARD VIOLA 8 SWITCHER
Q109
D164
From Lower Viola Driver Q93 See Dwg.5
EH
ER
Located at Tab Panel
VR17 10K
To Chorus Mixing Preamp IC28C Pt. QP See Dwg. 17
Lower Keyb. String Volume Control
ES
330Ω
F#6 - B6
C7 - F7
F#7 - C8
IC31D
LOWER KEYBOARD VIOLINA 4' SWITCHER
Q110
D165
From Lower Violina Driver Q92 See Dwg.5
EJ
2.2K

NOTES:
1. All resistors are 10%, 1/2 watt or less unless otherwise specified.
2. All capacitors are in microfarads unless otherwise specified.
3. All voltages measured to ground with a Simpson 260 V O M.
4. See Parts List for component part numbers.
5. All keyswitches, tabswitches and pushbutton switches shown in "off" position.
6. ✤ Denotes factory tailored component.
7. Bold line indicates R/S keying groups, one note example shown on Dwg. 5.
8. All components located on Symphonic String & Diapason Q.C. Board unless otherwise specified.

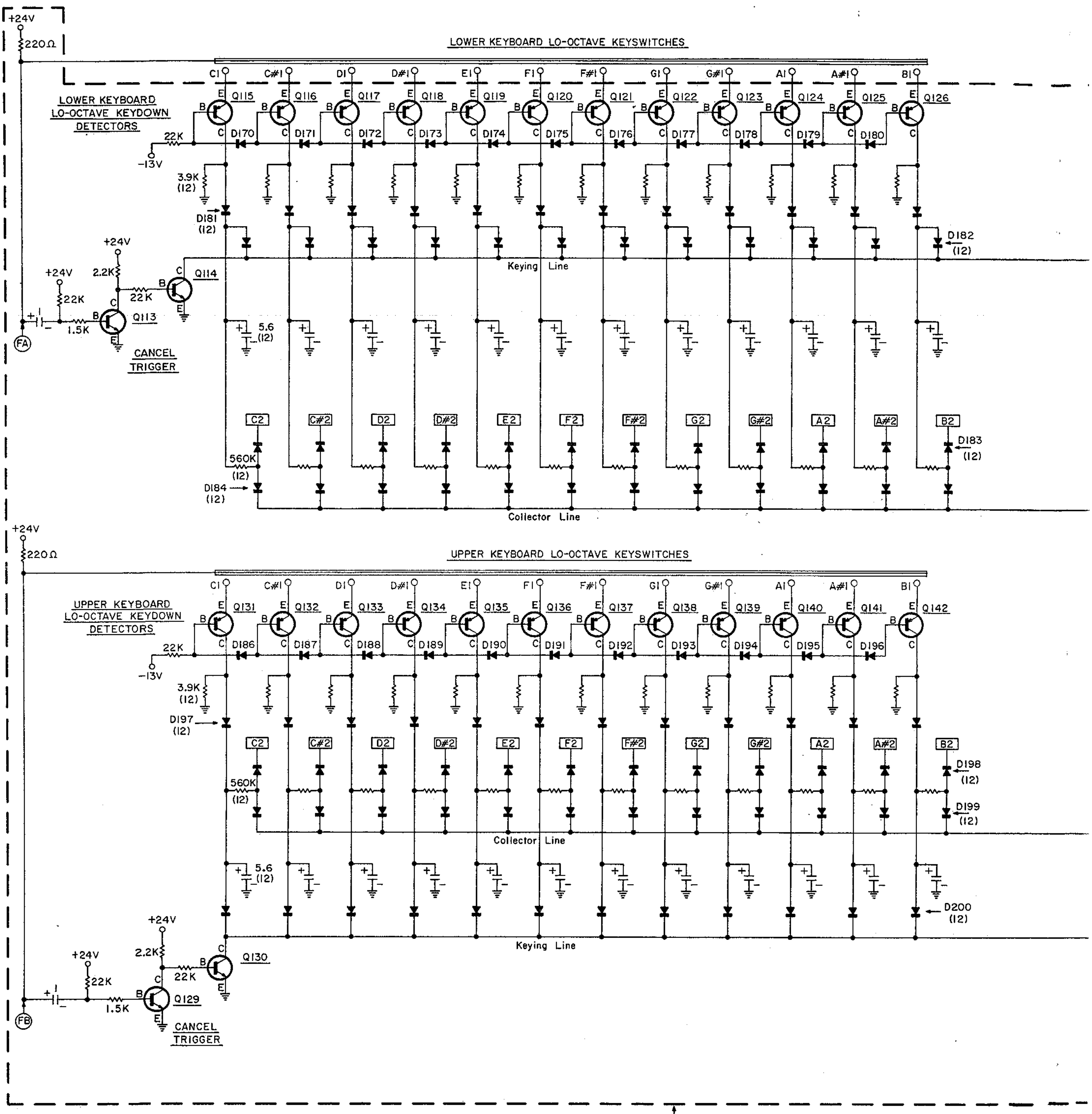
CAPACITOR VALUE CHART

Filter IC No.	C1	C2	C3
IC44A	.056	.075	.0022
IC44B	.039	.056	.0015
IC44C	.022	.039	.001
IC44D	.02	.027	750P
IC45A	.02	.039	.001
IC45B	.02	.027	750P
IC45C	.014	.02	560P
IC45D	.01	.014	390P
IC46A	.014	.02	560P
IC46B	.01	.014	390P
IC46C	.0068	.01	270P
IC46D	.0047	.0068	200P
IC47A	.0068	.01	270P
IC47B	.0047	.0068	200P
IC47C	.0033	.0047	130P
IC47D	.0024	.0033	82P
IC48A	.0033	.0047	130P
IC48B	.0024	.0033	82P
IC48C	.0016	.0024	68P
IC48D	.0012	.0016	47P

LOWER KEYBOARD DIAPASON
& SYMPHONIC STRING FILTERS
& GENIE MODULATOR

Dwg. No. 6
C500/
Model H25-4

SCHEMATIC 7

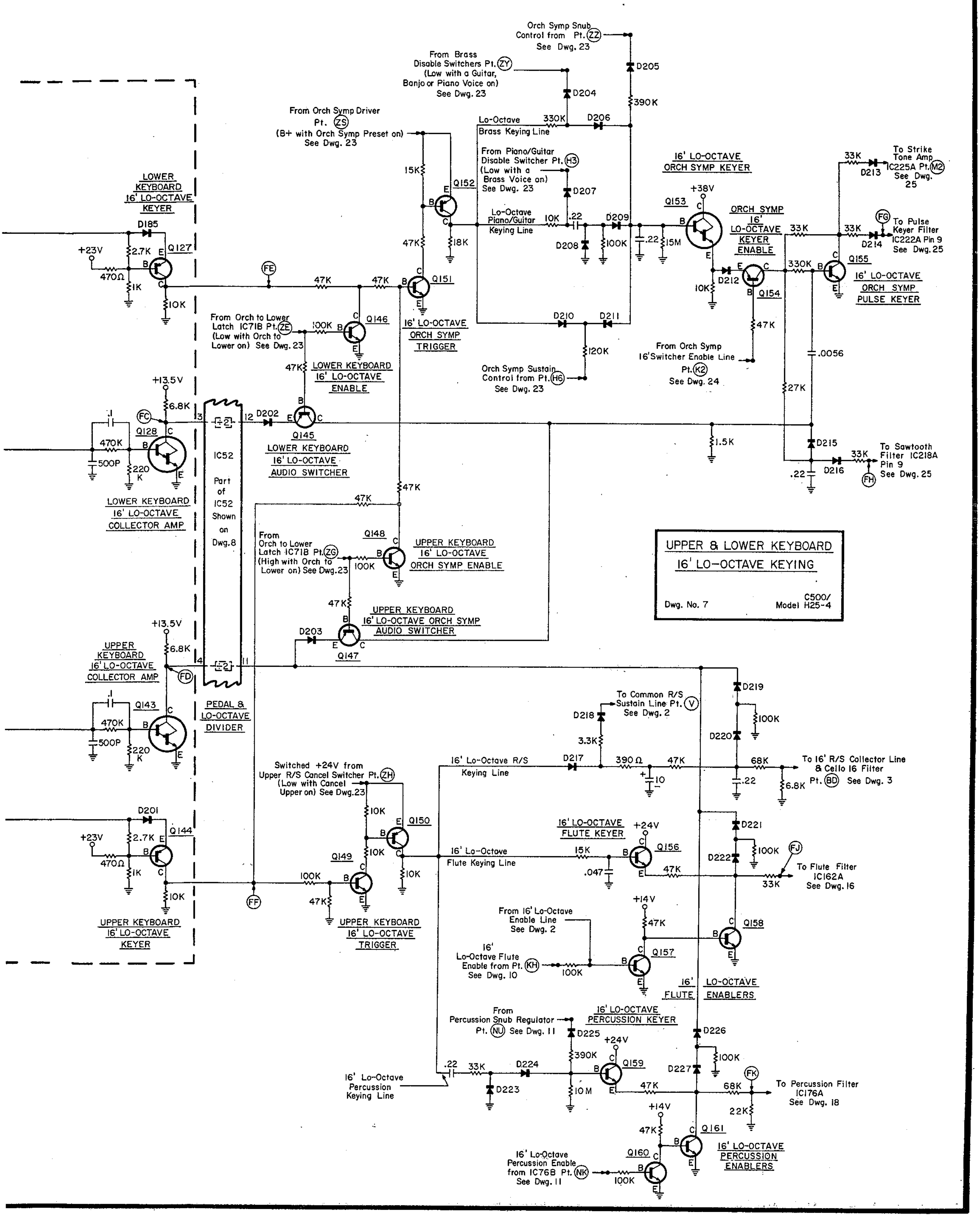

+24V
220Ω
LOWER KEYBOARD LO-OCTAVE KEYSWITCHES
C1
C#1
D1
D#1
E1
F1
F#1
G1
G#1
A1
A#1
B1
LOWER KEYBOARD LO-OCTAVE KEYDOWN DETECTORS
Q115
Q116
Q117
Q118
Q119
Q120
Q121
Q122
Q123
Q124
Q125
Q126
22K
-13V
D170
D171
D172
D173
D174
D175
D176
D177
D178
D179
D180
3.9K (12)
D181 (12)
D182 (12)
+24V
2.2K
Q114
Keying Line
+24V
22K
22K
1.5K
Q113
FA
CANCEL TRIGGER
5.6 (12)
C2
C#2
D2
D#2
E2
F2
F#2
G2
G#2
A2
A#2
B2
D183 (12)
560K (12)
D184 (12)
Collector Line
+24V
220Ω
UPPER KEYBOARD LO-OCTAVE KEYSWITCHES
UPPER KEYBOARD LO-OCTAVE KEYDOWN DETECTORS
Q131
Q132
Q133
Q134
Q135
Q136
Q137
Q138
Q139
Q140
Q141
Q142
D186
D187
D188
D189
D190
D191
D192
D193
D194
D195
D196
D197 (12)
D198 (12)
D199 (12)
D200 (12)
Q130
Q129
FB

Located on Tone Generator Board See Note 7

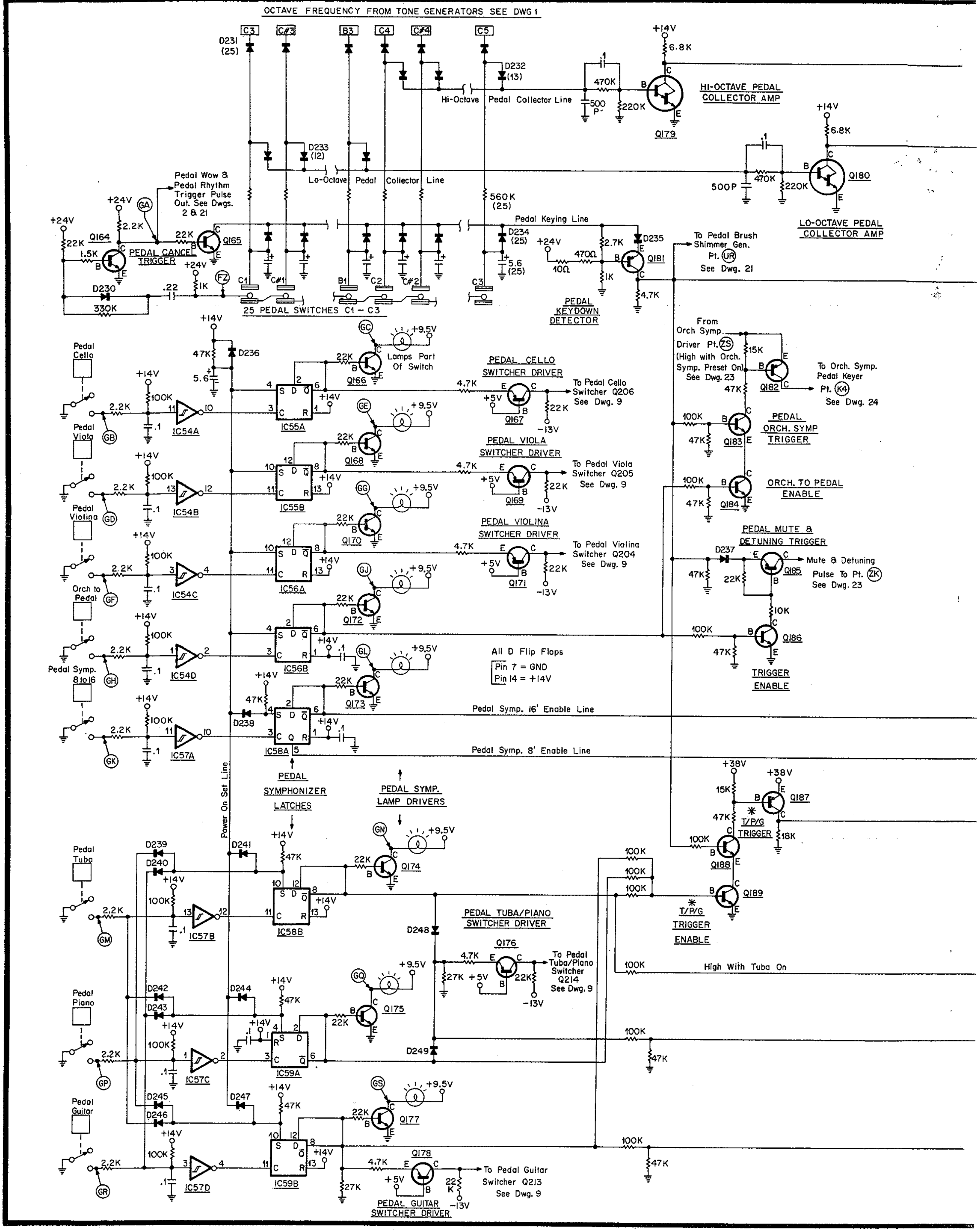
NOTES:

1. All resistors are 10%, 1/2 watt or less unless otherwise specified.
2. All Capacitors are in microfarads unless otherwise specified
3. All voltages measured to ground with a Simpson 260 VOM.
4. See Parts List for component part numbers.
5. All Keyswitches, Tabswitches and Pushbutton Switches shown in "off" position.
6. ✤ Denotes factory tailored component.
7. All components located on Pedal Symphonizer Q.C. & Control Board unless otherwise specified.

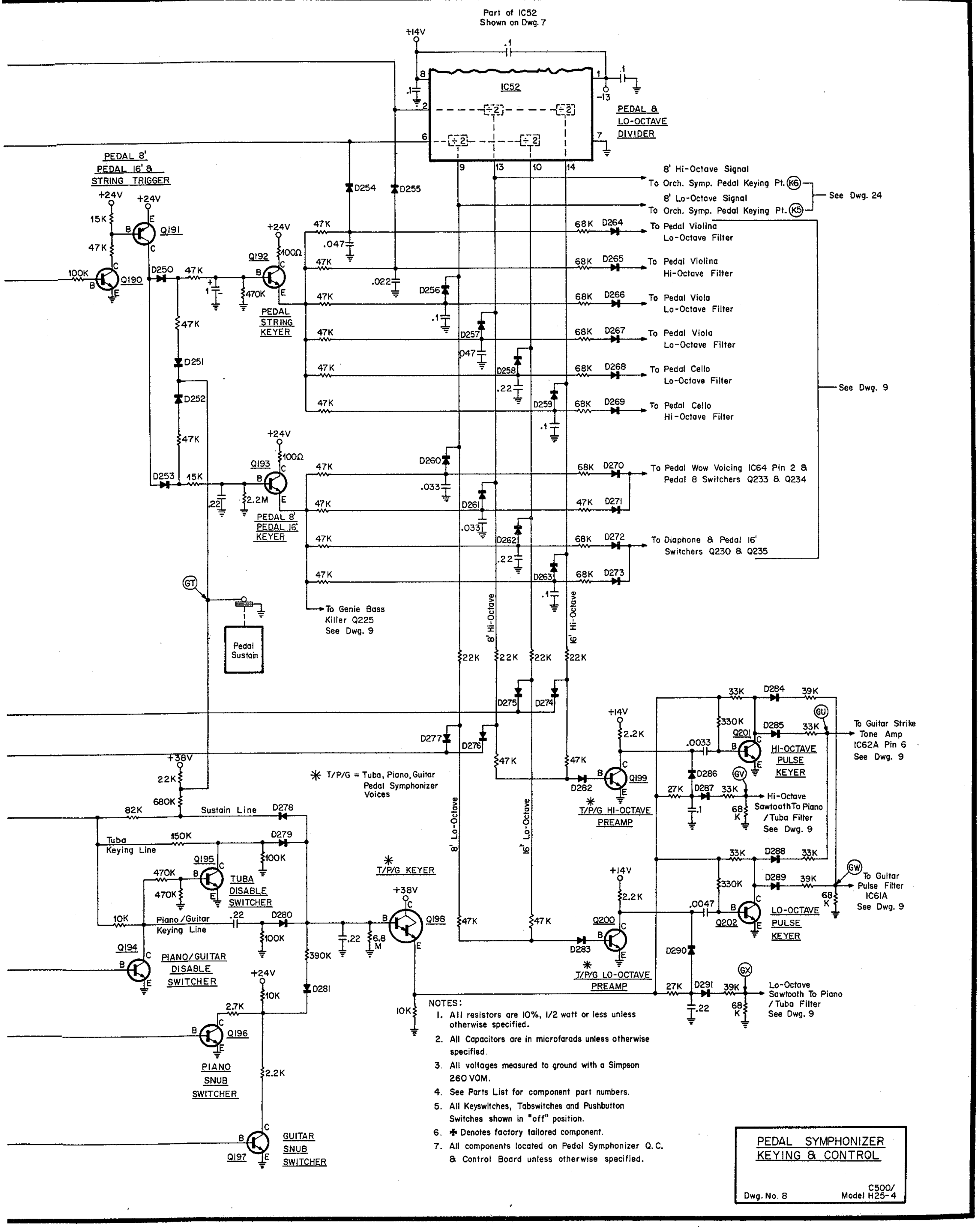
SCHEMATIC 7


UPPER & LOWER KEYBOARD
16' LO-OCTAVE KEYING
Dwg. No. 7
C500/ Model H25-4
Orch Symp Snub Control from Pt. (ZZ) See Dwg. 23
From Brass Disable Switchers Pt. (ZY) (Low with a Guitar, Banjo or Piano Voice on) See Dwg. 23
From Orch Symp Driver Pt. (ZS) (B+ with Orch Symp Preset on) See Dwg. 23
D205
D204
390K
Lo-Octave Brass Keying Line
330K
D206
From Piano/Guitar Disable Switcher Pt. (H3) (Low with a Brass Voice on) See Dwg. 23
D207
Lo-Octave Piano/Guitar Keying Line
10K
.22
D209
D208
100K
.22
15M
15K
Q152
18K
47K
Q151
16' LO-OCTAVE ORCH SYMP TRIGGER
D210
D211
120K
Orch Symp Sustain Control from Pt. (H6) See Dwg. 23
16' LO-OCTAVE ORCH SYMP KEYER
+38V
Q153
ORCH SYMP 16' LO-OCTAVE KEYER ENABLE
D212
Q154
10K
47K
From Orch Symp 16' Switcher Enable Line Pt. (K2) See Dwg. 24
33K
D213
To Strike Tone Amp IC225A Pt. (M2) See Dwg. 25
(FG) To Pulse Keyer Filter IC222A Pin 9 See Dwg. 25
D214
330K
Q155
16' LO-OCTAVE ORCH SYMP PULSE KEYER
.0056
27K
D215
D216
33K
.22
To Sawtooth Filter IC218A Pin 9 (FH) See Dwg. 25
1.5K
LOWER KEYBOARD 16' LO-OCTAVE KEYER
D185
+23V
2.7K
Q127
470Ω
1K
10K
(FE)
47K
From Orch to Lower Latch IC71B Pt. (ZE) (Low with Orch to Lower on) See Dwg. 23
100K
Q146
LOWER KEYBOARD 16' LO-OCTAVE ENABLE
+13.5V
6.8K
(FC)
Q128
470K
500P
220 K
IC52
Part of IC52 Shown on Dwg. 8
÷2
D202
Q145
LOWER KEYBOARD 16' LO-OCTAVE AUDIO SWITCHER
LOWER KEYBOARD 16' LO-OCTAVE COLLECTOR AMP
From Orch to Lower Latch IC71B Pt. (ZG) (High with Orch to Lower on) See Dwg. 23
Q148
UPPER KEYBOARD 16' LO-OCTAVE ORCH SYMP ENABLE
UPPER KEYBOARD 16' LO-OCTAVE ORCH SYMP AUDIO SWITCHER
D203
Q147
UPPER KEYBOARD 16' LO-OCTAVE COLLECTOR AMP
(FD)
Q143
PEDAL & LO-OCTAVE DIVIDER
D219
To Common R/S Sustain Line Pt. (V) See Dwg. 2
D218
3.3K
D220
16' Lo-Octave R/S Keying Line
D217
390Ω
10
68K
6.8K
To 16' R/S Collector Line & Cello 16 Filter Pt. (BD) See Dwg. 3
Switched +24V from Upper R/S Cancel Switcher Pt. (ZH) (Low with Cancel Upper on) See Dwg. 23
Q150
Q149
D201
Q144
(FF)
UPPER KEYBOARD 16' LO-OCTAVE KEYER
UPPER KEYBOARD 16' LO-OCTAVE TRIGGER
16' Lo-Octave Flute Keying Line
16' LO-OCTAVE FLUTE KEYER
+24V
Q156
.047
D221
D222
(FJ)
To Flute Filter IC162A See Dwg. 16
+14V
From 16' Lo-Octave Enable Line See Dwg. 2
16' Lo-Octave Flute Enable from Pt. (KH) See Dwg. 10
Q157
Q158
16' FLUTE LO-OCTAVE ENABLERS
From Percussion Snub Regulator Pt. (NU) See Dwg. 11
16' LO-OCTAVE PERCUSSION KEYER
D225
D226
D227
Q159
10M
D224
D223
16' Lo-Octave Percussion Keying Line
(FK)
To Percussion Filter IC176A See Dwg. 18
22K
Q161
Q160
16' Lo-Octave Percussion Enable from IC76B Pt. (NK) See Dwg. 11
16' LO-OCTAVE PERCUSSION ENABLERS

SCHEMATIC 8


OCTAVE FREQUENCY FROM TONE GENERATORS SEE DWG 1
C3
C#3
B3
C4
C#4
C5
D231 (25)
D232 (13)
D233 (12)
Hi-Octave Pedal Collector Line
Lo-Octave Pedal Collector Line
HI-OCTAVE PEDAL COLLECTOR AMP
LO-OCTAVE PEDAL COLLECTOR AMP
Q179
Q180
+14V
6.8K
470K
220K
500 P
.1
500P
560K (25)
Pedal Keying Line
D234 (25)
D235
5.6 (25)
2.7K
470Ω
10Ω
1K
4.7K
Q181
PEDAL KEYDOWN DETECTOR
To Pedal Brush Shimmer Gen. Pt. UR See Dwg. 21
Pedal Wow & Pedal Rhythm Trigger Pulse Out. See Dwgs. 2 & 21
GA
+24V
2.2K
22K
1.5K
Q164
Q165
PEDAL CANCEL TRIGGER
FZ
D230
.22
330K
C1
C#1
B1
C2
C#2
C3
25 PEDAL SWITCHES C1 – C3
D236
47K
5.6
Pedal Cello
Pedal Viola
Pedal Violina
Orch to Pedal
Pedal Symp. 8 to 16
GB
GD
GF
GH
GK
100K
.1
IC54A
IC54B
IC54C
IC54D
IC57A
IC55A
IC55B
IC56A
IC56B
IC58A
GC
GE
GG
GJ
GL
+9.5V
Lamps Part Of Switch
Q166
Q168
Q170
Q172
Q173
PEDAL CELLO SWITCHER DRIVER
PEDAL VIOLA SWITCHER DRIVER
PEDAL VIOLINA SWITCHER DRIVER
Q167
Q169
Q171
To Pedal Cello Switcher Q206 See Dwg. 9
To Pedal Viola Switcher Q205 See Dwg. 9
To Pedal Violina Switcher Q204 See Dwg. 9
+5V
-13V
All D Flip Flops
Pin 7 = GND
Pin 14 = +14V
D238
Pedal Symp. 16' Enable Line
Pedal Symp. 8' Enable Line
PEDAL SYMPHONIZER LATCHES
PEDAL SYMP. LAMP DRIVERS
Power On Set Line
From Orch Symp. Driver Pt. ZS (High with Orch. Symp. Preset On) See Dwg. 23
15K
Q182
To Orch. Symp. Pedal Keyer Pt. K4 See Dwg. 24
PEDAL ORCH. SYMP TRIGGER
Q183
ORCH. TO PEDAL ENABLE
Q184
PEDAL MUTE & DETUNING TRIGGER
D237
Q185
Mute & Detuning Pulse To Pt. ZK See Dwg. 23
10K
Q186
TRIGGER ENABLE
+38V
Q187
18K
* T/P/G TRIGGER
Q188
Q189
* T/P/G TRIGGER ENABLE
High With Tuba On
Pedal Tuba
Pedal Piano
Pedal Guitar
GM
GP
GR
GN
GQ
GS
D239
D240
D241
D242
D243
D244
D245
D246
D247
D248
D249
IC57B
IC57C
IC57D
IC58B
IC59A
IC59B
Q174
Q175
Q177
PEDAL TUBA/PIANO SWITCHER DRIVER
Q176
27K
To Pedal Tuba/Piano Switcher Q214 See Dwg. 9
Q178
To Pedal Guitar Switcher Q213 See Dwg. 9
PEDAL GUITAR SWITCHER DRIVER

SCHEMATIC 8


Part of IC52
Shown on Dwg. 7
+14V
.1
IC52
8
2
6
1
-13
7
9
13
10
14
÷2
PEDAL & LO-OCTAVE DIVIDER
8' Hi-Octave Signal
To Orch. Symp. Pedal Keying Pt. K6
8' Lo-Octave Signal
To Orch. Symp. Pedal Keying Pt. K5
See Dwg. 24
PEDAL 8'
PEDAL 16' &
STRING TRIGGER
+24V
15K
47K
100K
Q190
Q191
D250
D251
D252
D253
D254
D255
D256
D257
D258
D259
D260
D261
D262
D263
47K
1
470K
100Ω
Q192
PEDAL STRING KEYER
.047
.022
.1
.22
.033
68K
D264
To Pedal Violina Lo-Octave Filter
D265
To Pedal Violina Hi-Octave Filter
D266
To Pedal Viola Lo-Octave Filter
D267
To Pedal Viola Lo-Octave Filter
D268
To Pedal Cello Lo-Octave Filter
D269
To Pedal Cello Hi-Octave Filter
See Dwg. 9
Q193
2.2M
PEDAL 8'
PEDAL 16'
KEYER
D270
To Pedal Wow Voicing IC64 Pin 2 &
Pedal 8 Switchers Q233 & Q234
D271
D272
To Diaphone & Pedal 16' Switchers Q230 & Q235
D273
To Genie Bass Killer Q225
See Dwg. 9
GT
Pedal Sustain
8' Hi-Octave
16' Hi-Octave
22K
D274
D275
D276
D277
+38V
680K
82K
Sustain Line
D278
Tuba Keying Line
150K
D279
Q195
TUBA DISABLE SWITCHER
470K
10K
Piano/Guitar Keying Line
D280
Q194
PIANO/GUITAR DISABLE SWITCHER
390K
D281
+24V
2.7K
Q196
PIANO SNUB SWITCHER
2.2K
Q197
GUITAR SNUB SWITCHER
✱ T/P/G = Tuba, Piano, Guitar
Pedal Symphonizer Voices
8' Lo-Octave
16' Lo-Octave
✱ T/P/G KEYER
Q198
6.8 M
10K
Q199
D282
✱ T/P/G HI-OCTAVE PREAMP
Q200
D283
✱ T/P/G LO-OCTAVE PREAMP
33K
D284
39K
330K
Q201
D285
GU
.0033
HI-OCTAVE PULSE KEYER
To Guitar Strike Tone Amp IC62A Pin 6
See Dwg. 9
D286
GV
27K
D287
68 K
Hi-Octave Sawtooth To Piano / Tuba Filter
See Dwg. 9
D288
D289
GW
To Guitar Pulse Filter IC61A
See Dwg. 9
.0047
Q202
LO-OCTAVE PULSE KEYER
D290
GX
D291
Lo-Octave Sawtooth To Piano / Tuba Filter
See Dwg. 9

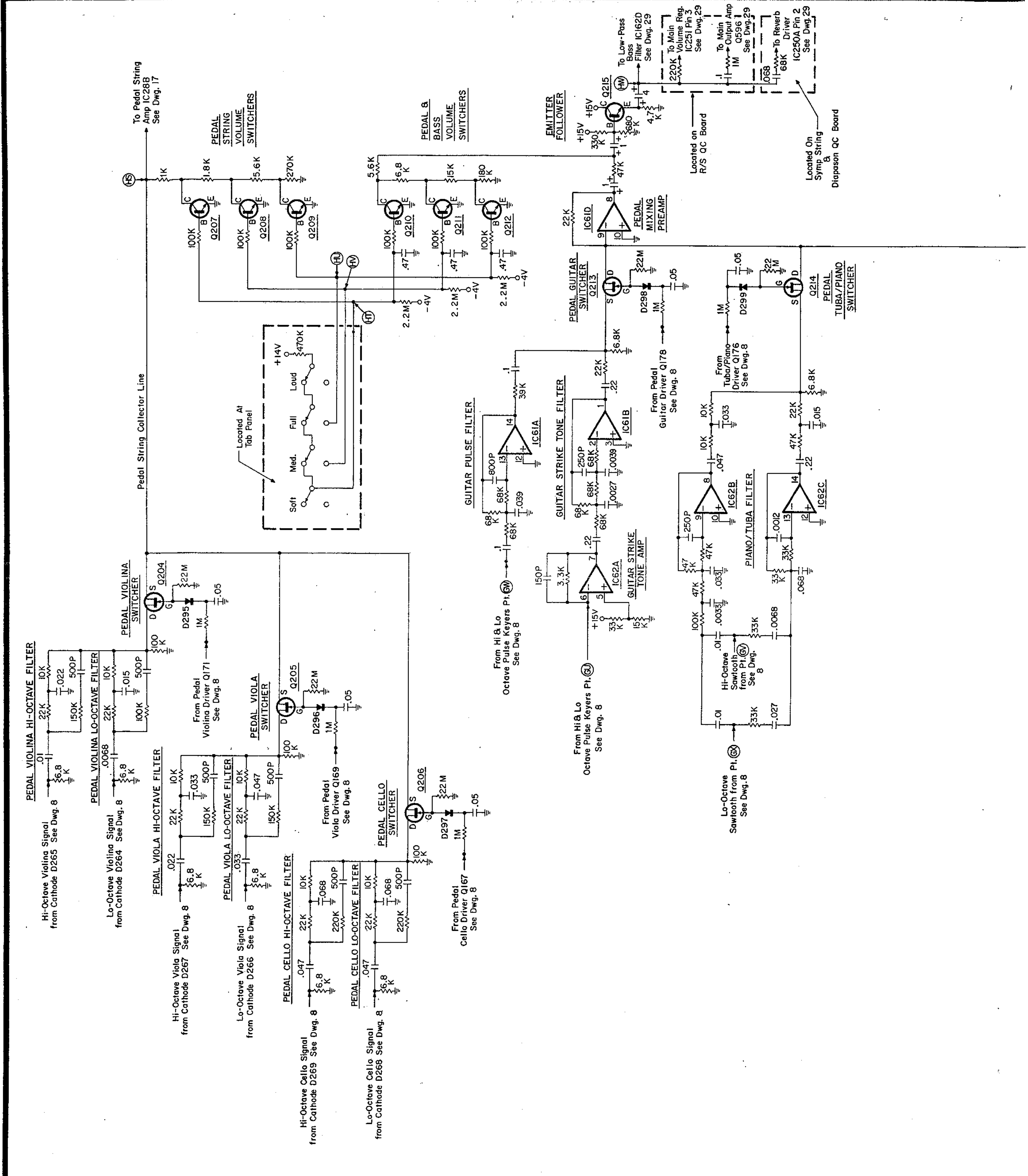
NOTES:

1. All resistors are 10%, 1/2 watt or less unless otherwise specified.
2. All Capacitors are in microfarads unless otherwise specified.
3. All voltages measured to ground with a Simpson 260 VOM.
4. See Parts List for component part numbers.
5. All Keyswitches, Tabswitches and Pushbutton Switches shown in "off" position.
6. ✱ Denotes factory tailored component.
7. All components located on Pedal Symphonizer Q.C. & Control Board unless otherwise specified.

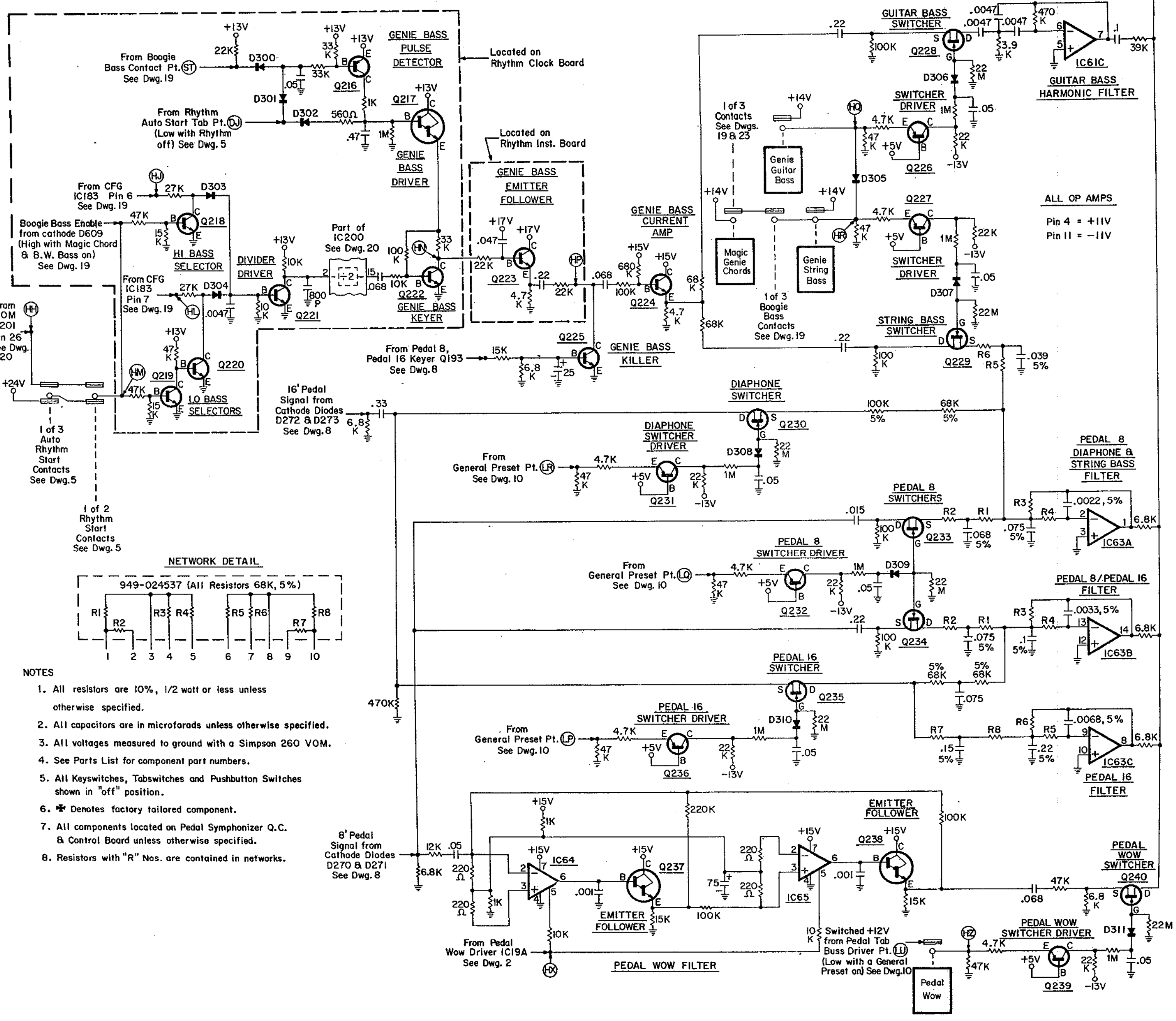
PEDAL SYMPHONIZER
KEYING & CONTROL

Dwg. No. 8
C500/
Model H25-4

SCHEMATIC 9


To Pedal String Amp IC28B See Dwg. 17
Pedal String Collector Line
PEDAL STRING VOLUME SWITCHERS
Q207
Q208
Q209
PEDAL & BASS VOLUME SWITCHERS
Q210
Q211
Q212
EMITTER FOLLOWER
Q215
To Low-Pass Bass Filter IC162D See Dwg. 29
To Main Volume Reg. IC251 Pin 3 See Dwg.29
To Main Output Amp Q596 See Dwg.29
To Reverb Driver IC250A Pin 2 See Dwg.29
Located on R/S QC Board
Located On Symp String & Diapason QC Board
PEDAL MIXING PREAMP
IC61D
PEDAL GUITAR SWITCHER Q213
D298
From Pedal Guitar Driver Q178 See Dwg. 8
Q214
PEDAL TUBA/PIANO SWITCHER
D299
From Tuba/Piano Driver Q176 See Dwg.8
Located At Tab Panel
+14V
Soft
Med.
Full
Loud
GUITAR PULSE FILTER
IC61A
GUITAR STRIKE TONE FILTER
IC61B
GUITAR STRIKE TONE AMP
IC62A
From Hi & Lo Octave Pulse Keyers Pt. GW See Dwg.8
From Hi & Lo Octave Pulse Keyers Pt. GU See Dwg. 8
PIANO/TUBA FILTER
IC62B
IC62C
Hi-Octave Sawtooth from Pt. GV See Dwg. 8
Lo-Octave Sawtooth from Pt. GX See Dwg.8
PEDAL VIOLINA SWITCHER
Q204
D295
From Pedal Violina Driver Q171 See Dwg. 8
PEDAL VIOLINA HI-OCTAVE FILTER
PEDAL VIOLINA LO-OCTAVE FILTER
Hi-Octave Violina Signal from Cathode D265 See Dwg.8
Lo-Octave Violina Signal from Cathode D264 See Dwg. 8
PEDAL VIOLA SWITCHER
Q205
D296
From Pedal Viola Driver Q169 See Dwg.8
PEDAL VIOLA HI-OCTAVE FILTER
PEDAL VIOLA LO-OCTAVE FILTER
Hi-Octave Viola Signal from Cathode D267 See Dwg. 8
Lo-Octave Viola Signal from Cathode D266 See Dwg. 8
PEDAL CELLO SWITCHER
Q206
D297
From Pedal Cello Driver Q167 See Dwg. 8
PEDAL CELLO HI-OCTAVE FILTER
PEDAL CELLO LO-OCTAVE FILTER
Hi-Octave Cello Signal from Cathode D269 See Dwg. 8
Lo-Octave Cello Signal from Cathode D268 See Dwg. 8

SCHEMATIC 9

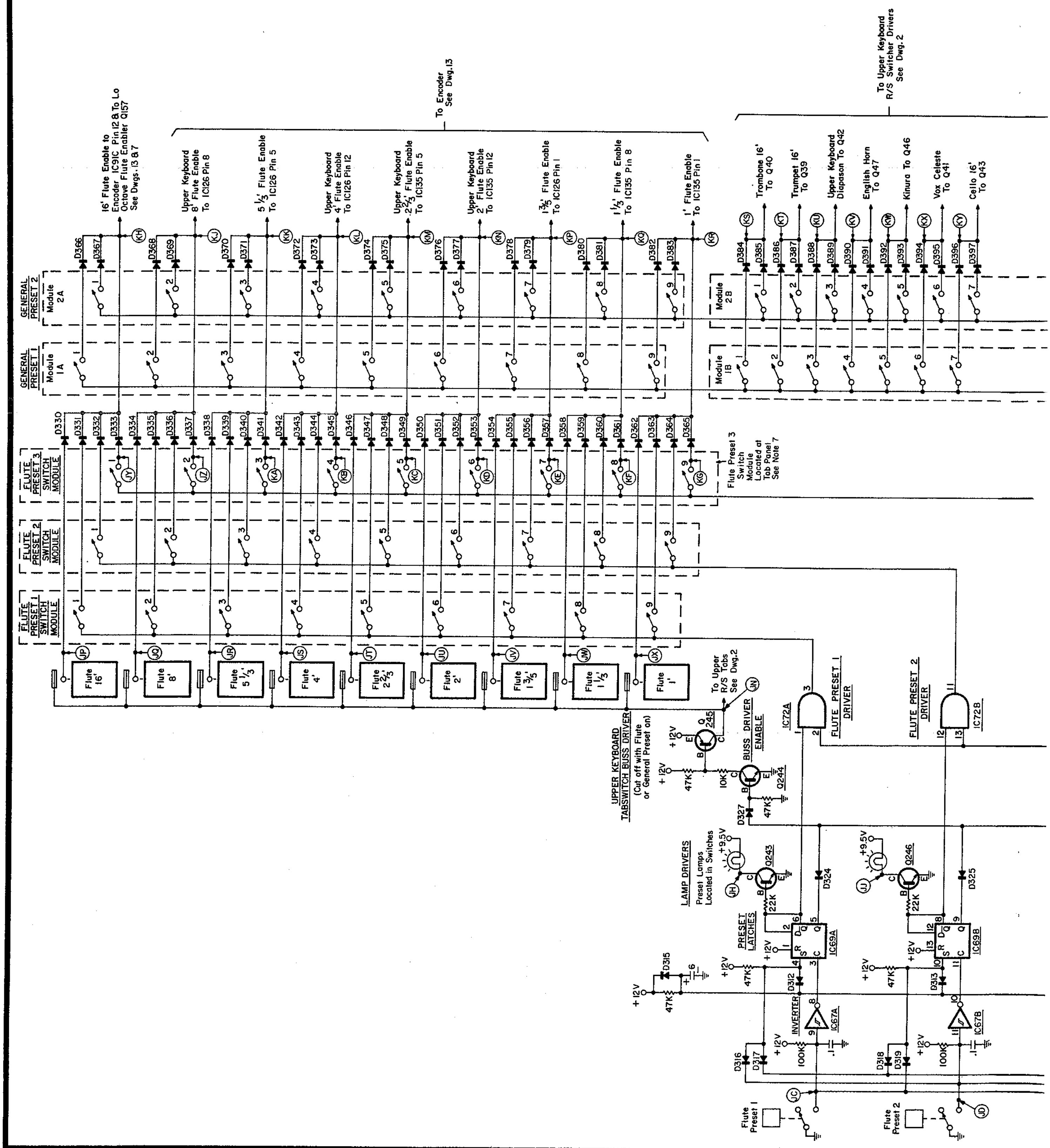

GENIE BASS PULSE DETECTOR
Located on Rhythm Clock Board
From Boogie Bass Contact Pt. (ST) See Dwg. 19
From Rhythm Auto Start Tab Pt. (DJ) (Low with Rhythm off) See Dwg. 5
+13V
22K
D300
D301
D302
.05
33K
33K
Q216
1K
560Ω
.47
1M
Q217
GENIE BASS DRIVER
From CFG IC183 Pin 6 See Dwg. 19
(HJ)
27K
D303
47K
Q218
15K
HI BASS SELECTOR
Boogie Bass Enable from cathode D609 (High with Magic Chord & B.W. Bass on) See Dwg. 19
From CFG IC183 Pin 7 See Dwg. 19
27K
D304
(HL)
.0047
DIVIDER DRIVER
10K
10K
Q221
Part of IC200 See Dwg. 20
÷2
800 P
.068
100K
10K
(HN)
33K
Q222
GENIE BASS KEYER
Q219
Q220
47K
15K
LO BASS SELECTORS
(HM)
From ROM IC201 Pin 26 See Dwg. 20
(HH)
+24V
1 of 3 Auto Rhythm Start Contacts See Dwg. 5
1 of 2 Rhythm Start Contacts See Dwg. 5
Located on Rhythm Inst. Board
GENIE BASS EMITTER FOLLOWER
+17V
.047
22K
Q223
.22
4.7K
22K
(HP)
.068
680K
100K
+15V
Q224
GENIE BASS CURRENT AMP
68K
4.7K
68K
Q225
GENIE BASS KILLER
From Pedal 8, Pedal 16 Keyer Q193 See Dwg. 8
15K
6.8K
25
16' Pedal Signal from Cathode Diodes D272 & D273 See Dwg. 8
.33
6.8K
470K
1 of 3 Contacts See Dwgs. 19 & 23
+14V
Genie Guitar Bass
Magic Genie Chords
Genie String Bass
1 of 3 Boogie Bass Contacts See Dwg. 19
(HQ)
(HR)
D305
Q226
Q227
SWITCHER DRIVER
4.7K
47K
+5V
1M
22K
-13V
.05
D306
D307
22M
GUITAR BASS SWITCHER
Q228
.22
100K
.0047
3.9K
470K
IC61C
GUITAR BASS HARMONIC FILTER
.1
39K
STRING BASS SWITCHER
Q229
100K
R6
R5
.039 5%
ALL OP AMPS
Pin 4 = +11V
Pin 11 = -11V
DIAPHONE SWITCHER
Q230
100K 5%
68K 5%
DIAPHONE SWITCHER DRIVER
From General Preset Pt. (LR) See Dwg. 10
Q231
D308
PEDAL 8 SWITCHERS
.015
Q233
R2
R1
.068 5%
.075 5%
R3
R4
.0022, 5%
IC63A
PEDAL 8 DIAPHONE & STRING BASS FILTER
6.8K
PEDAL 8 SWITCHER DRIVER
From General Preset Pt. (LQ) See Dwg. 10
Q232
D309
Q234
.1 5%
.0033, 5%
IC63B
PEDAL 8/PEDAL 16 FILTER
PEDAL 16 SWITCHER
Q235
5% 68K
.075
PEDAL 16 SWITCHER DRIVER
From General Preset Pt. (LP) See Dwg. 10
Q236
D310
R7
R8
.15 5%
.22 5%
.0068, 5%
IC63C
PEDAL 16 FILTER
8' Pedal Signal from Cathode Diodes D270 & D271 See Dwg. 8
12K
.05
6.8K
220Ω
1K
IC64
.001
Q237
EMITTER FOLLOWER
15K
100K
220K
75
IC65
Q238
EMITTER FOLLOWER
From Pedal Wow Driver IC19A See Dwg. 2
(HX)
PEDAL WOW FILTER
10K Switched +12V from Pedal Tab Buss Driver Pt. (LI) (Low with a General Preset on) See Dwg. 10
Pedal Wow
(HZ)
PEDAL WOW SWITCHER DRIVER
Q239
PEDAL WOW SWITCHER
Q240
47K
.068
D311
22M
NETWORK DETAIL
949-024537 (All Resistors 68K, 5%)
R1 R2 R3 R4 R5 R6 R7 R8
1 2 3 4 5 6 7 8 9 10

NOTES

1. All resistors are 10%, 1/2 watt or less unless otherwise specified.
2. All capacitors are in microfarads unless otherwise specified.
3. All voltages measured to ground with a Simpson 260 VOM.
4. See Parts List for component part numbers.
5. All Keyswitches, Tabswitches and Pushbutton Switches shown in "off" position.
6. ✠ Denotes factory tailored component.
7. All components located on Pedal Symphonizer Q.C. & Control Board unless otherwise specified.
8. Resistors with "R" Nos. are contained in networks.

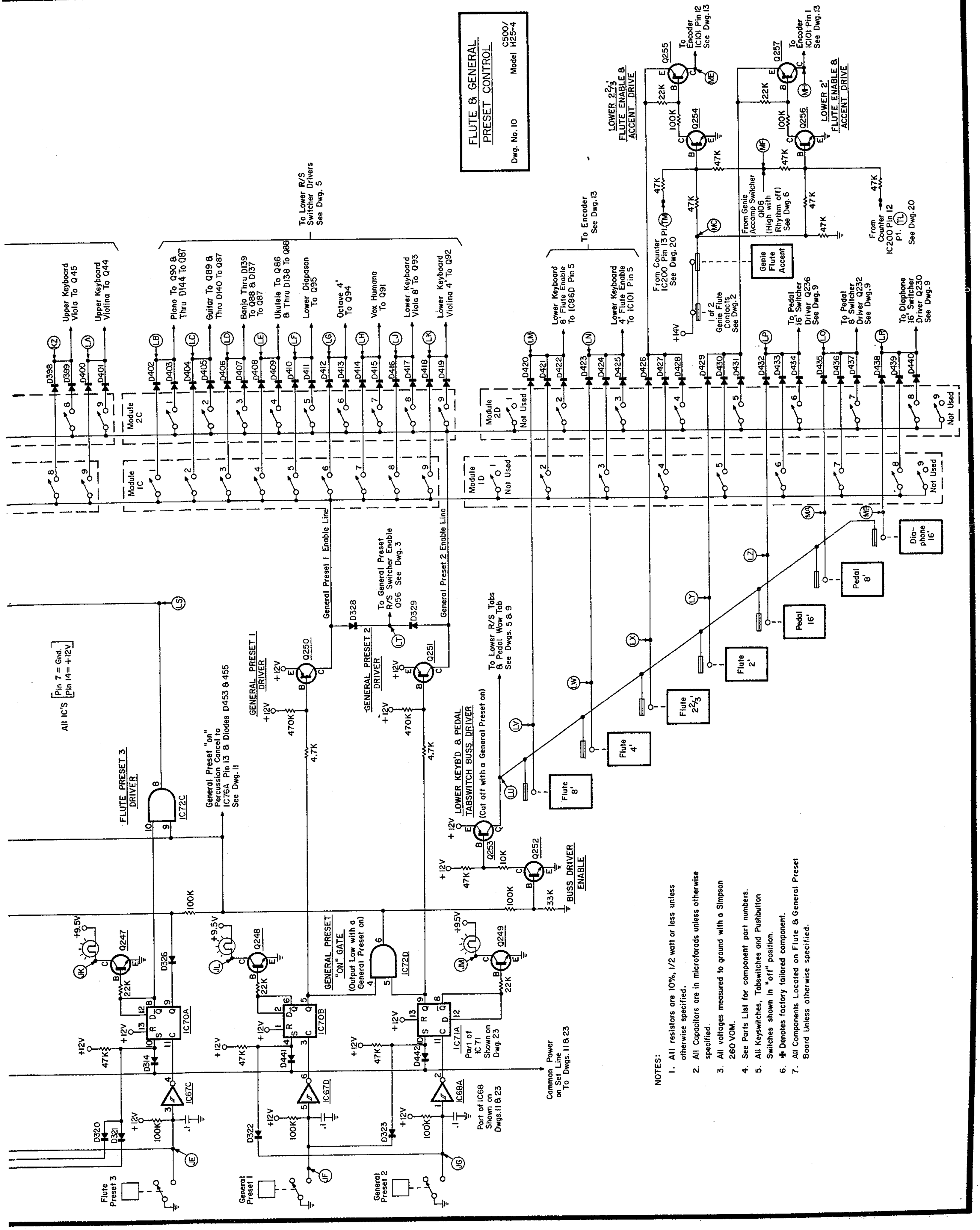
PEDAL SYMPHONIZER
VOICING & GENIE BASS
Dwg. No. 9
C500/
Model H25-4

SCHEMATIC 10



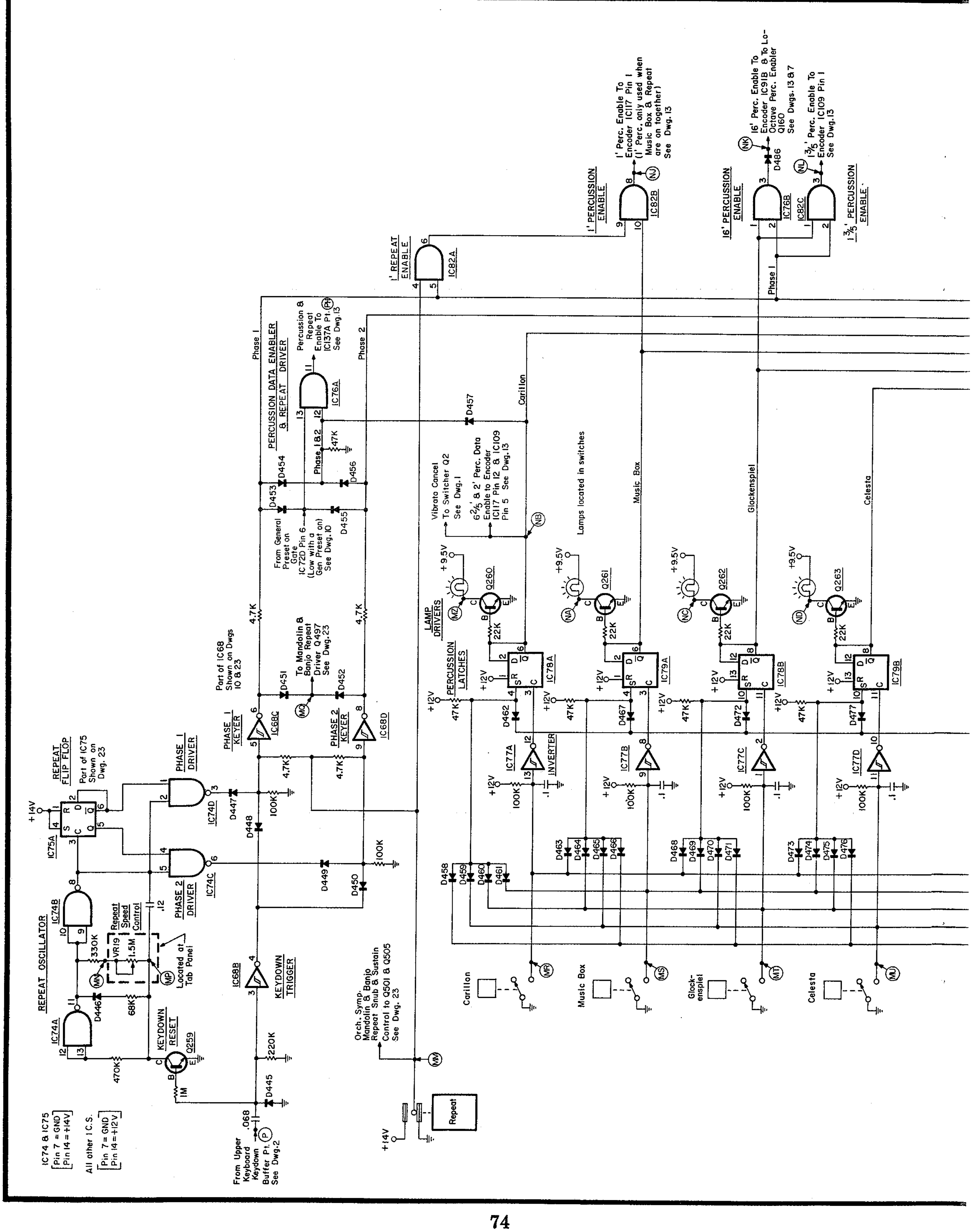
16' Flute Enable to Encoder IC91C Pin 12 & To Lo Octave Flute Enabler Q157 See Dwgs. 13 & 7
To Encoder See Dwg. 13
Upper Keyboard 8' Flute Enable To IC126 Pin 8
5 1/3' Flute Enable To IC126 Pin 5
Upper Keyboard 4' Flute Enable To IC126 Pin 12
Upper Keyboard 2 2/3' Flute Enable To IC135 Pin 5
Upper Keyboard 2' Flute Enable To IC135 Pin 12
1 3/5' Flute Enable To IC126 Pin 1
1 1/3' Flute Enable To IC135 Pin 8
1' Flute Enable To IC135 Pin 1
To Upper Keyboard R/S Switcher Drivers See Dwg. 2
Trombone 16' To Q40
Trumpet 16' To Q39
Upper Keyboard Diapason To Q42
English Horn To Q47
Kinura To Q46
Vox Celeste To Q41
Cello 16' To Q43
KH
KJ
KK
KL
KM
KN
KP
KQ
KR
KS
KT
KU
KV
KW
KX
KY
GENERAL PRESET 2
Module 2A
Module 2B
GENERAL PRESET 1
Module 1A
Module 1B
FLUTE PRESET 3 SWITCH MODULE
FLUTE PRESET 2 SWITCH MODULE
FLUTE PRESET 1 SWITCH MODULE
Flute Preset 3 Switch Module Located at Tab Panel See Note 7
JY
JZ
KA
KB
KC
KD
KE
KF
KG
JP
JQ
JR
JS
JT
JU
JV
JW
JX
Flute 16'
Flute 8'
Flute 5 1/3'
Flute 4'
Flute 2 2/3'
Flute 2'
Flute 1 3/5'
Flute 1 1/3'
Flute 1'
To Upper R/S Tabs See Dwg. 2
JN
UPPER KEYBOARD TABSWITCH BUSS DRIVER
(Cut off with Flute or General Preset on)
Q245
BUSS DRIVER ENABLE
Q244
IC72A
FLUTE PRESET 1 DRIVER
FLUTE PRESET 2 DRIVER
IC72B
LAMP DRIVERS
Preset Lamps Located in Switches
Q243
Q246
+9.5V
+12V
47K
10K
22K
100K
.1
6
D327
D324
D325
PRESET LATCHES
IC69A
IC69B
INVERTER
IC67A
IC67B
D312
D313
D315
D316
D317
D318
D319
JH
JJ
JC
JD
Flute Preset 1
Flute Preset 2
D330 D331 D332 D333 D334 D335 D336 D337 D338 D339 D340 D341 D342 D343 D344 D345 D346 D347 D348 D349 D350 D351 D352 D353 D354 D355 D356 D357 D358 D359 D360 D361 D362 D363 D364 D365
D366 D367 D368 D369 D370 D371 D372 D373 D374 D375 D376 D377 D378 D379 D380 D381 D382 D383
D384 D385 D386 D387 D388 D389 D390 D391 D392 D393 D394 D395 D396 D397

SCHEMATIC 10

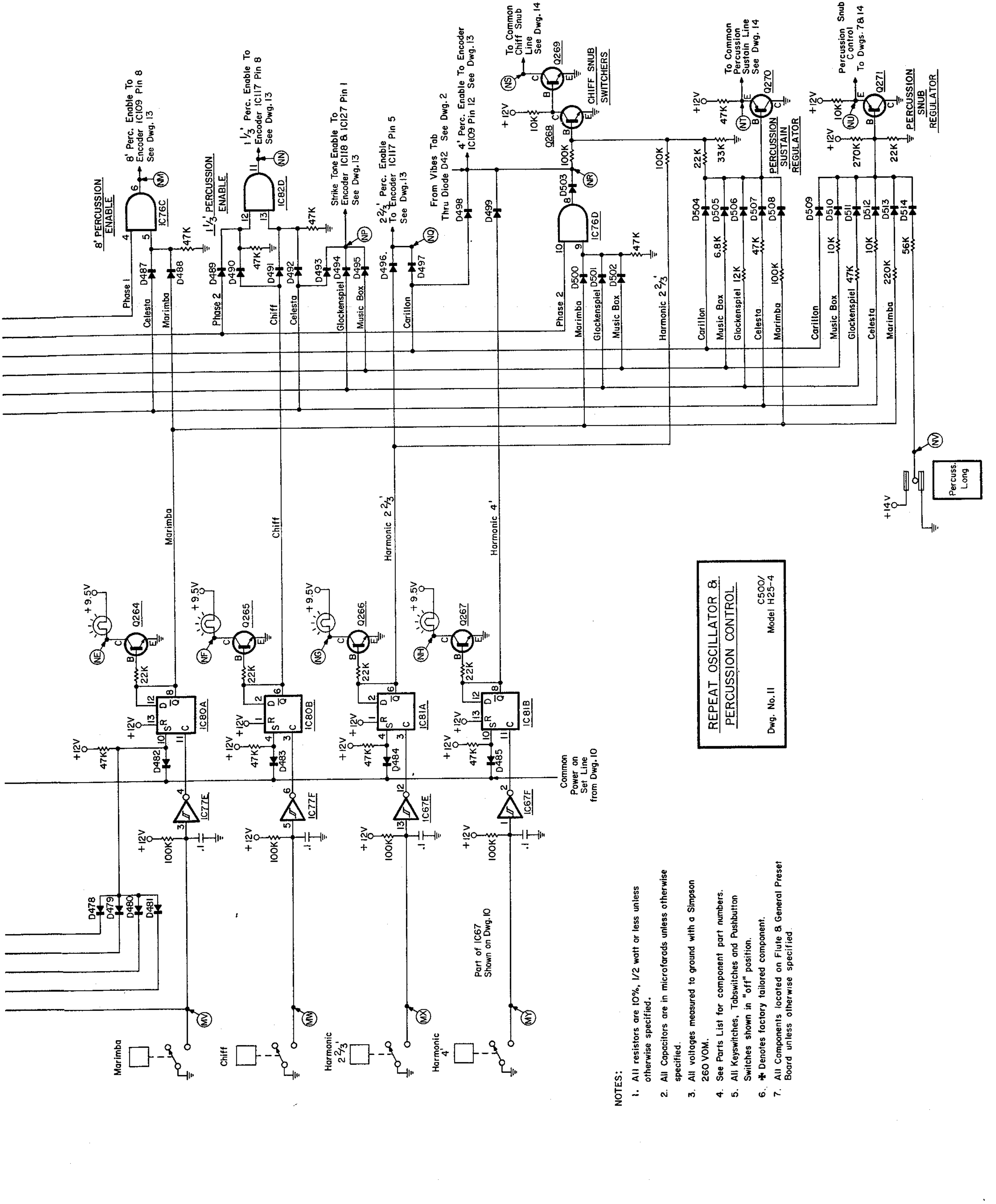

FLUTE & GENERAL PRESET CONTROL
Dwg. No. 10
Model C500/H25-4
LOWER 2 2/3' FLUTE ENABLE & ACCENT DRIVE
LOWER 2' FLUTE ENABLE & ACCENT DRIVE
To Encoder IC101 Pin 12 See Dwg.13
To Encoder IC101 Pin 1 See Dwg.13
Q255
Q254
Q257
Q256
22K
100K
47K
From Genie Accomp Switcher Q106 (High with Rhythm off) See Dwg.6
From Counter IC200 Pin 13 Pl. See Dwg. 20
From Counter IC200 Pin 12 Pl. See Dwg. 20
Genie Flute Accent
1 of 2 Genie Flute Contacts See Dwg.2
+14V
To Encoder See Dwg.13
To Lower R/S Switcher Drivers See Dwg. 5
Upper Keyboard Viola To Q45
Upper Keyboard Violina To Q44
Piano To Q90 & Thru D144 To Q87
Guitar To Q89 & Thru D140 To Q87
Banjo Thru D139 To Q88 & D137 To Q87
Ukulele To Q86 & Thru D138 To Q88
Lower Diapason To Q95
Octave 4' To Q94
Vox Humana To Q91
Lower Keyboard Viola 8' To Q93
Lower Keyboard Violina 4' To Q92
Lower Keyboard 8' Flute Enable To IC86D Pin 5
Lower Keyboard 4' Flute Enable To IC101 Pin 5
To Pedal 16' Switcher Driver Q236 See Dwg.9
To Pedal 8' Switcher Driver Q232 See Dwg.9
To Diaphone 16' Switcher Driver Q230 See Dwg.9
Module 2C
Module 1C
Module 2D
Module 1D
Not Used
General Preset 1 Enable Line
General Preset 2 Enable Line
To General Preset R/S Switcher Enable Q56 See Dwg. 3
GENERAL PRESET 1 DRIVER
GENERAL PRESET 2 DRIVER
Q250
Q251
D328
D329
470K
4.7K
To Lower R/S Tabs & Pedal Wow Tab See Dwgs. 5 & 9
LOWER KEYB'D & PEDAL TABSWITCH BUSS DRIVER (Cut off with a General Preset on)
Q253
Q252
BUSS DRIVER ENABLE
33K
10K
Flute 8'
Flute 4'
Flute 2 2/3'
Flute 2'
Pedal 16'
Pedal 8'
Diaphone 16'
All IC'S [Pin 7 = Gnd. Pin 14 = +12V]
FLUTE PRESET 3 DRIVER
IC72C
General Preset "on" Percussion Cancel to IC76A Pin 13 & Diodes D453 & 455 See Dwg.11
GENERAL PRESET "ON" GATE (Output Low with a General Preset on)
IC72D
IC70A
IC70B
IC71A
Part of IC71 Shown on Dwg. 23
IC67C
IC67D
IC68A
Part of IC68 Shown on Dwgs.11 & 23
Q247
Q248
Q249
+9.5V
+12V
Common Power on Set Line To Dwgs. 11 & 23
Flute Preset 3
General Preset 1
General Preset 2

NOTES:
1. All resistors are 10%, 1/2 watt or less unless otherwise specified.
2. All Capacitors are in microfarads unless otherwise specified.
3. All voltages measured to ground with a Simpson 260 VOM.
4. See Parts List for component part numbers.
5. All Keyswitches, Tabswitches and Pushbutton Switches shown in "off" position.
6. ✱ Denotes factory tailored component.
7. All Components Located on Flute & General Preset Board Unless otherwise specified.

SCHEMATIC 11


REPEAT OSCILLATOR
IC74A
IC74B
REPEAT FLIP FLOP
Part of IC75 Shown on Dwg. 23
IC75A
+14V
Repeat Speed Control
VR19
1.5M
330K
68K
470K
D446
.12
Located at Tab Panel
KEYDOWN RESET
Q259
1M
PHASE 1 DRIVER
PHASE 2 DRIVER
IC74D
IC74C
D447
D448
D449
D450
100K
4.7K
PHASE 1 KEYER
PHASE 2 KEYER
IC68C
IC68D
Part of IC68 Shown on Dwgs 10 & 23
D451
D452
To Mandolin & Banjo Repeat Driver Q497 See Dwg. 23
IC68B
KEYDOWN TRIGGER
220K
D445
.068
From Upper Keyboard Keydown Buffer Pt. P See Dwg. 2
IC74 & IC75 [Pin 7 = GND Pin 14 = +14V]
All other I.C.S. [Pin 7 = GND Pin 14 = +12V]
Orch. Symp. Mandolin & Banjo Repeat Snub & Sustain Control to Q501 & Q505 See Dwg. 23
Repeat
+14V
PERCUSSION DATA ENABLER & REPEAT DRIVER
IC76A
Percussion & Repeat Enable To IC137A Pt. PH See Dwg. 13
Phase 1
Phase 2
Phase 1 & 2
47K
D453
D454
D455
D456
D457
From General Preset on Gate IC72D Pin 6 (Low with a Gen Preset on) See Dwg. 10
1' REPEAT ENABLE
IC82A
1' PERCUSSION ENABLE
IC82B
1' Perc. Enable To Encoder IC117 Pin 1 (1' Perc. only used when Music Box & Repeat are on together) See Dwg. 13
16' PERCUSSION ENABLE
IC76B
16' Perc. Enable To Encoder IC91B & To Lo-Octave Perc. Enabler Q160 See Dwgs. 13 & 7
D486
1 3/5' PERCUSSION ENABLE
IC82C
1 3/5' Perc. Enable To Encoder IC109 Pin 1 See Dwg. 13
Carillon
Music Box
Glockenspiel
Celesta
Vibrato Cancel To Switcher Q2 See Dwg. 1
6 2/3' & 2' Perc. Data Enable to Encoder IC117 Pin 12 & IC109 Pin 5 See Dwg. 13
Lamps located in switches
LAMP DRIVERS
+9.5V
Q260
Q261
Q262
Q263
22K
PERCUSSION LATCHES
IC78A
IC79A
IC78B
IC79B
+12V
47K
D462
D467
D472
D477
INVERTER
IC77A
IC77B
IC77C
IC77D
100K
.1
D458
D459
D460
D461
D463
D464
D465
D466
D468
D469
D470
D471
D473
D474
D475
D476
Carillon
Music Box
Glock-enspiel
Celesta
MR
MS
MT
MU
MW
MX
MP
MQ
MZ
NA
NB
NC
ND
NJ
NK
NL

SCHEMATIC II


8' PERCUSSION ENABLE
8' Perc. Enable To Encoder IC109 Pin 8 See Dwg. 13
IC76C
NM
1 1/3' PERCUSSION ENABLE
1 1/3' Perc. Enable To Encoder IC117 Pin 8 See Dwg. 13
IC82D
NN
Strike Tone Enable To Encoder IC118 & IC127 Pin 1 See Dwg. 13
NP
2 2/3' Perc. Enable To Encoder IC117 Pin 5 See Dwg. 13
NQ
From Vibes Tab Thru Diode D42 See Dwg. 2
4' Perc. Enable To Encoder IC109 Pin 12 See Dwg. 13
To Common Chiff Snub Line See Dwg. 14
NS
Q269
Q268
CHIFF SNUB SWITCHERS
NR
IC76D
To Common Percussion Sustain Line See Dwg. 14
NT
Q270
PERCUSSION SUSTAIN REGULATOR
Percussion Snub Control To Dwgs. 7 & 14
NU
Q271
PERCUSSION SNUB REGULATOR
NV
Percuss. Long
+14V
+12V
47K
10K
100K
22K
33K
270K
6.8K
12K
220K
56K
D487
D488
D489
D490
D491
D492
D493
D494
D495
D496
D497
D498
D499
D500
D501
D502
D503
D504
D505
D506
D507
D508
D509
D510
D511
D512
D513
D514
Phase 1
Phase 2
Celesta
Marimba
Chiff
Glockenspiel
Music Box
Carillon
Harmonic 2 2/3'
Harmonic 4'
+9.5V
NE
NF
NG
NH
Q264
Q265
Q266
Q267
IC80A
IC80B
IC81A
IC81B
D482
D483
D484
D485
Common Power on Set Line from Dwg. 10
IC77E
IC77F
IC67E
IC67F
.1
Part of IC67 Shown on Dwg. 10
D478
D479
D480
D481
MV
MW
MX
MY
Marimba
Chiff
Harmonic 2 2/3'
Harmonic 4'

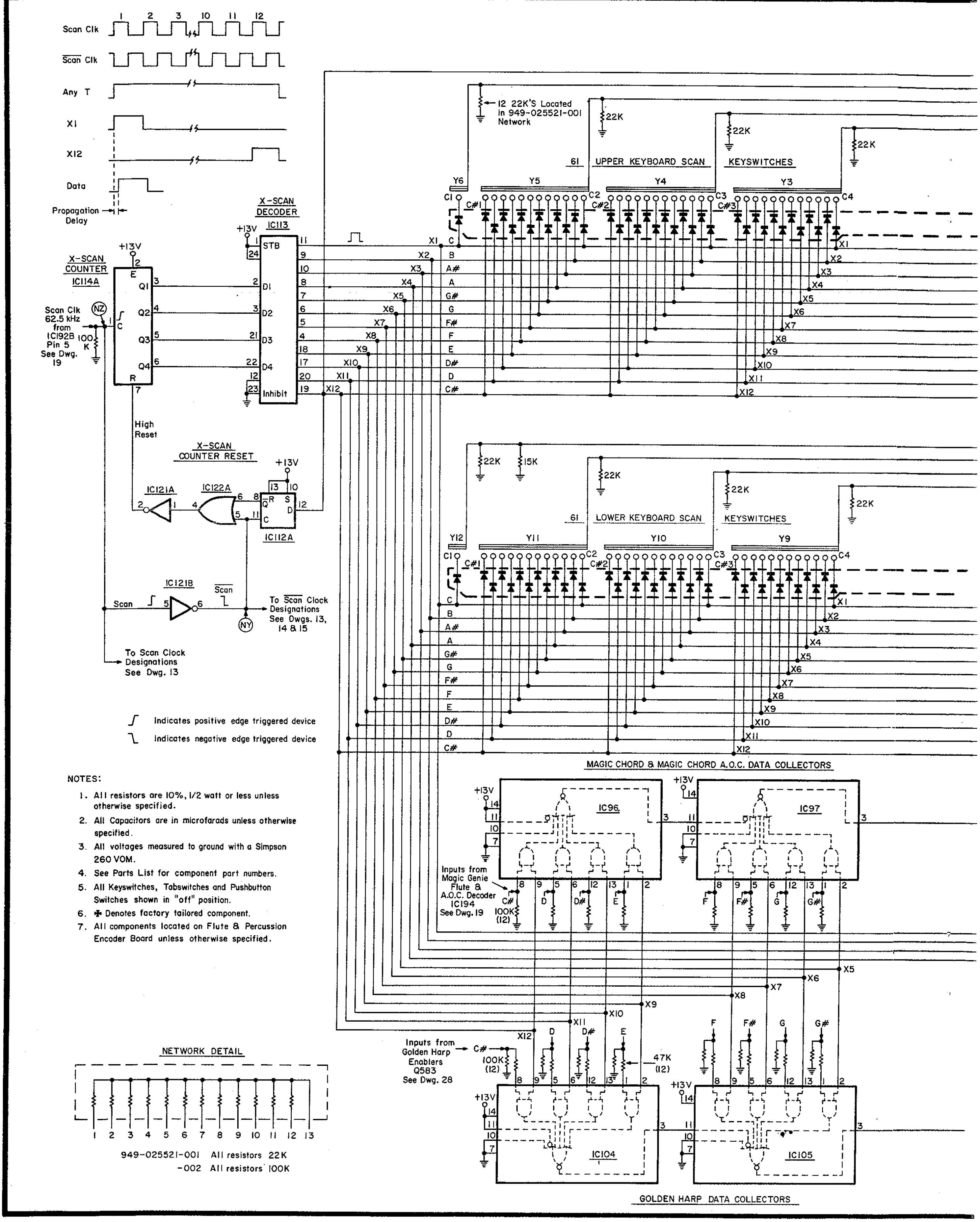
REPEAT OSCILLATOR &
PERCUSSION CONTROL

Dwg. No. 11
C500/
Model H25-4

NOTES:

1. All resistors are 10%, 1/2 watt or less unless otherwise specified.
2. All Capacitors are in microfarads unless otherwise specified.
3. All voltages measured to ground with a Simpson 260 VOM.
4. See Parts List for component part numbers.
5. All Keyswitches, Tabswitches and Pushbutton Switches shown in "off" position.
6. ✱ Denotes factory tailored component.
7. All Components located on Flute & General Preset Board unless otherwise specified.

SCHEMATIC 12


1 2 3 10 11 12
Scan Clk
Scan Clk
Any T
X1
X12
Data
Propagation Delay
X-SCAN DECODER
IC113
+13V
STB
D1
D2
D3
D4
Inhibit
X-SCAN COUNTER
IC114A
+13V
E
Q1
Q2
Q3
Q4
C
R
Scan Clk 62.5 kHz from IC192B Pin 5 See Dwg. 19
NZ
100 K
High Reset
X-SCAN COUNTER RESET
IC121A
IC122A
IC112A
IC121B
Scan
Scan
NY
To Scan Clock Designations See Dwgs. 13, 14 & 15
To Scan Clock Designations See Dwg. 13
12 22K'S Located in 949-025521-001 Network
22K
15K
61
UPPER KEYBOARD SCAN
KEYSWITCHES
LOWER KEYBOARD SCAN
Y6
Y5
Y4
Y3
Y12
Y11
Y10
Y9
C1
C2
C3
C4
C#1
C#2
C#3
C
B
A#
A
G#
G
F#
F
E
D#
D
C#
X1
X2
X3
X4
X5
X6
X7
X8
X9
X10
X11
X12
MAGIC CHORD & MAGIC CHORD A.O.C. DATA COLLECTORS
IC96
IC97
Inputs from Magic Genie Flute & A.O.C. Decoder IC194 See Dwg. 19
100K (12)
Inputs from Golden Harp Enablers Q583 See Dwg. 28
47K (12)
IC104
IC105
GOLDEN HARP DATA COLLECTORS
NETWORK DETAIL
1 2 3 4 5 6 7 8 9 10 11 12 13
949-025521-001 All resistors 22K
-002 All resistors 100K

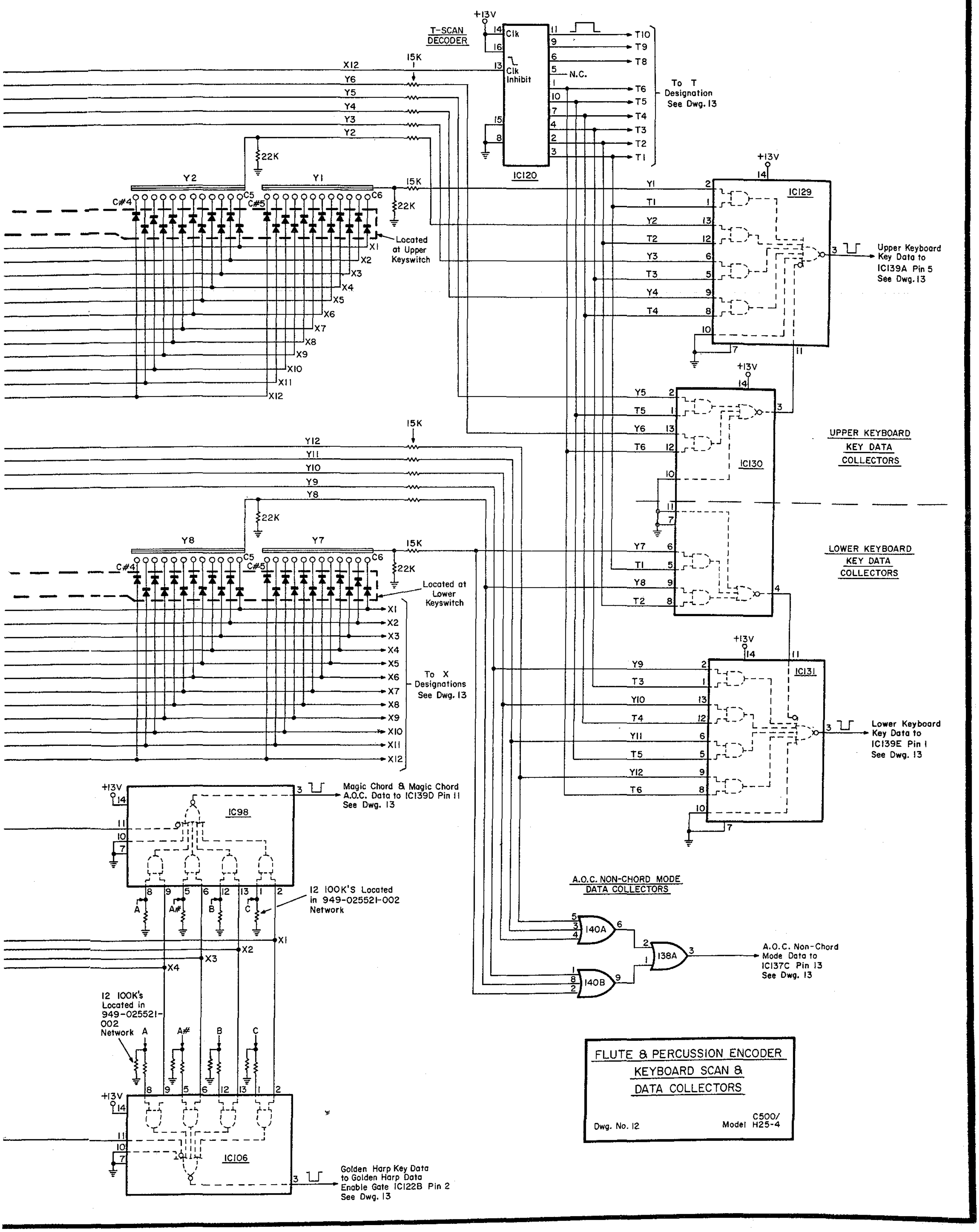
ʃ Indicates positive edge triggered device

Ↄ Indicates negative edge triggered device

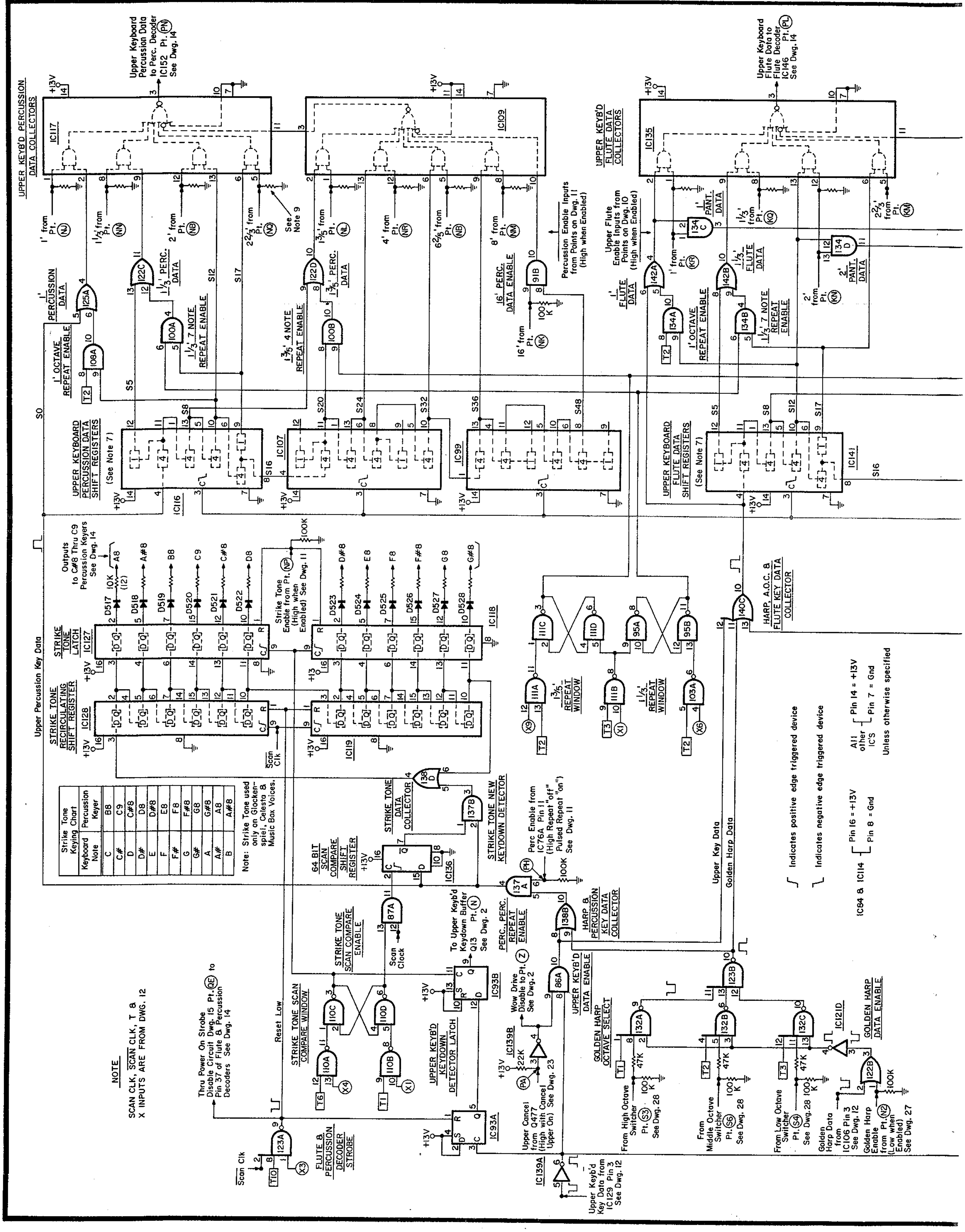
NOTES:

1. All resistors are 10%, 1/2 watt or less unless otherwise specified.
2. All Capacitors are in microfarads unless otherwise specified.
3. All voltages measured to ground with a Simpson 260 VOM.
4. See Parts List for component part numbers.
5. All Keyswitches, Tabswitches and Pushbutton Switches shown in "off" position.
6. ✱ Denotes factory tailored component.
7. All components located on Flute & Percussion Encoder Board unless otherwise specified.

SCHEMATIC 12


T-SCAN DECODER
+13V
Clk
Clk Inhibit
N.C.
IC120
T10
T9
T8
T6
T5
T4
T3
T2
T1
To T Designation See Dwg. 13
X12
Y6
Y5
Y4
Y3
Y2
15K
22K
Y2
Y1
C#4
C5
C#5
C6
Located at Upper Keyswitch
X1
X2
X3
X4
X5
X6
X7
X8
X9
X10
X11
X12
IC129
Upper Keyboard Key Data to IC139A Pin 5 See Dwg. 13
IC130
UPPER KEYBOARD KEY DATA COLLECTORS
LOWER KEYBOARD KEY DATA COLLECTORS
Y12
Y11
Y10
Y9
Y8
Y7
Located at Lower Keyswitch
To X Designations See Dwg. 13
IC131
Lower Keyboard Key Data to IC139E Pin 1 See Dwg. 13
IC98
Magic Chord & Magic Chord A.O.C. Data to IC139D Pin 11 See Dwg. 13
A
A#
B
C
12 100K'S Located in 949-025521-002 Network
12 100K's Located in 949-025521-002 Network
IC106
Golden Harp Key Data to Golden Harp Data Enable Gate IC122B Pin 2 See Dwg. 13
A.O.C. NON-CHORD MODE DATA COLLECTORS
140A
140B
138A
A.O.C. Non-Chord Mode Data to IC137C Pin 13 See Dwg. 13
FLUTE & PERCUSSION ENCODER
KEYBOARD SCAN &
DATA COLLECTORS
Dwg. No. 12
C500/ Model H25-4

SCHEMATIC 13


UPPER KEYB'D PERCUSSION DATA COLLECTORS
IC117
IC109
Upper Keyboard Percussion Data to Perc. Decoder IC152 Pt. (PN) See Dwg. 14
UPPER KEYB'D FLUTE DATA COLLECTORS
IC135
Upper Keyboard Flute Data to Flute Decoder IC146 Pt. (PL) See Dwg. 14
1' from Pt. (NJ)
1 1/3' from Pt. (NN)
2' from Pt. (NB)
2 2/3' from Pt. (NQ)
See Note 9
1 3/5' from Pt. (NL)
4' from Pt. (NR)
6 2/5' from Pt. (NB)
8' from Pt. (NM)
16' from Pt. (NK)
Percussion Enable Inputs from Points on Dwg. 11 (High when Enabled)
Upper Flute Enable Inputs from Points on Dwg. 10 (High when Enabled)
1' PERCUSSION DATA
1 1/3' PERC. DATA
1 3/5' PERC. DATA
16' PERC. DATA ENABLE
1' OCTAVE REPEAT ENABLE
1 1/3' 7 NOTE REPEAT ENABLE
1 3/5' 4 NOTE REPEAT ENABLE
1' FLUTE DATA
1 1/3' FLUTE DATA
1' PANT. DATA
2' PANT. DATA
1' from Pt. (KR)
1 1/3' from Pt. (KQ)
2 2/3' from Pt. (KM)
2' from Pt. (KN)
UPPER KEYBOARD PERCUSSION DATA SHIFT REGISTERS (See Note 7)
IC116
IC107
IC99
UPPER KEYBOARD FLUTE DATA SHIFT REGISTERS (See Note 7)
IC141
Upper Percussion Key Data
Outputs to C#8 Thru C9 Percussion Keyers See Dwg. 14
A8 A#8 B8 C9 C#8 D8 D#8 E8 F8 F#8 G8 G#8
D517 D518 D519 D520 D521 D522 D523 D524 D525 D526 D527 D528
Strike Tone Enable from Pt. (NP) (High when Enabled) See Dwg. 11
STRIKE TONE LATCH IC127
IC118
STRIKE TONE RECIRCULATING SHIFT REGISTER IC128
IC119
1 3/5' REPEAT WINDOW
1 1/3' REPEAT WINDOW
HARP, A.O.C. & FLUTE KEY DATA COLLECTOR
STRIKE TONE DATA COLLECTOR
STRIKE TONE NEW KEYDOWN DETECTOR
64 BIT SCAN COMPARE SHIFT REGISTER
IC136
Perc Enable from IC76A Pin 11 (High Repeat "off" Pulsed Repeat "on") See Dwg. 11
PERC. PERC. REPEAT ENABLE
HARP & PERCUSSION KEY DATA COLLECTOR
Upper Key Data
Golden Harp Data
STRIKE TONE SCAN COMPARE ENABLE
STRIKE TONE SCAN COMPARE WINDOW
To Upper Keyb'd Keydown Buffer Q13 Pt. (N) See Dwg. 2
UPPER KEYB'D KEYDOWN DETECTOR LATCH
IC93B
IC93A
Wow Drive Disable to Pt. (Z) See Dwg. 2
UPPER KEYB'D DATA ENABLE
GOLDEN HARP OCTAVE SELECT
GOLDEN HARP DATA ENABLE
IC121D
IC139B
IC139A
Upper Cancel from Q477 (High with Cancel Upper On) See Dwg. 23
Upper Keyb'd Key Data from IC129 Pin 3 See Dwg. 12
From High Octave Switcher Pt. (S3) See Dwg. 28
From Middle Octave Switcher Pt. (S6) See Dwg. 28
From Low Octave Switcher Pt. (S4) See Dwg. 28
Golden Harp Data from IC106 Pin 3 See Dwg. 12
Golden Harp Enable from Pt. (N2) (Low when Enabled) See Dwg. 27
FLUTE & PERCUSSION DECODER STROBE
Thru Power On Strobe Disable Circuit Dwg. 15 Pt. (QE) to Pin 37 of Flute & Percussion Decoders See Dwg. 14
Reset Low
Scan Clk
Scan Clock
+13V

Keyboard Note	Percussion Keyer
C	B8
C#	C9
D	C#8
D#	D8
E	D#8
F	E8
F#	F8
G	F#8
G#	G8
A	G#8
A#	A8
B	A#8

Strike Tone Keying Chart

Note: Strike Tone used only on Glockenspiel, Celesta & Music Box Voices.

NOTE

SCAN CLK, $\overline{\text{SCAN}}$ CLK, T & X INPUTS ARE FROM DWG. 12

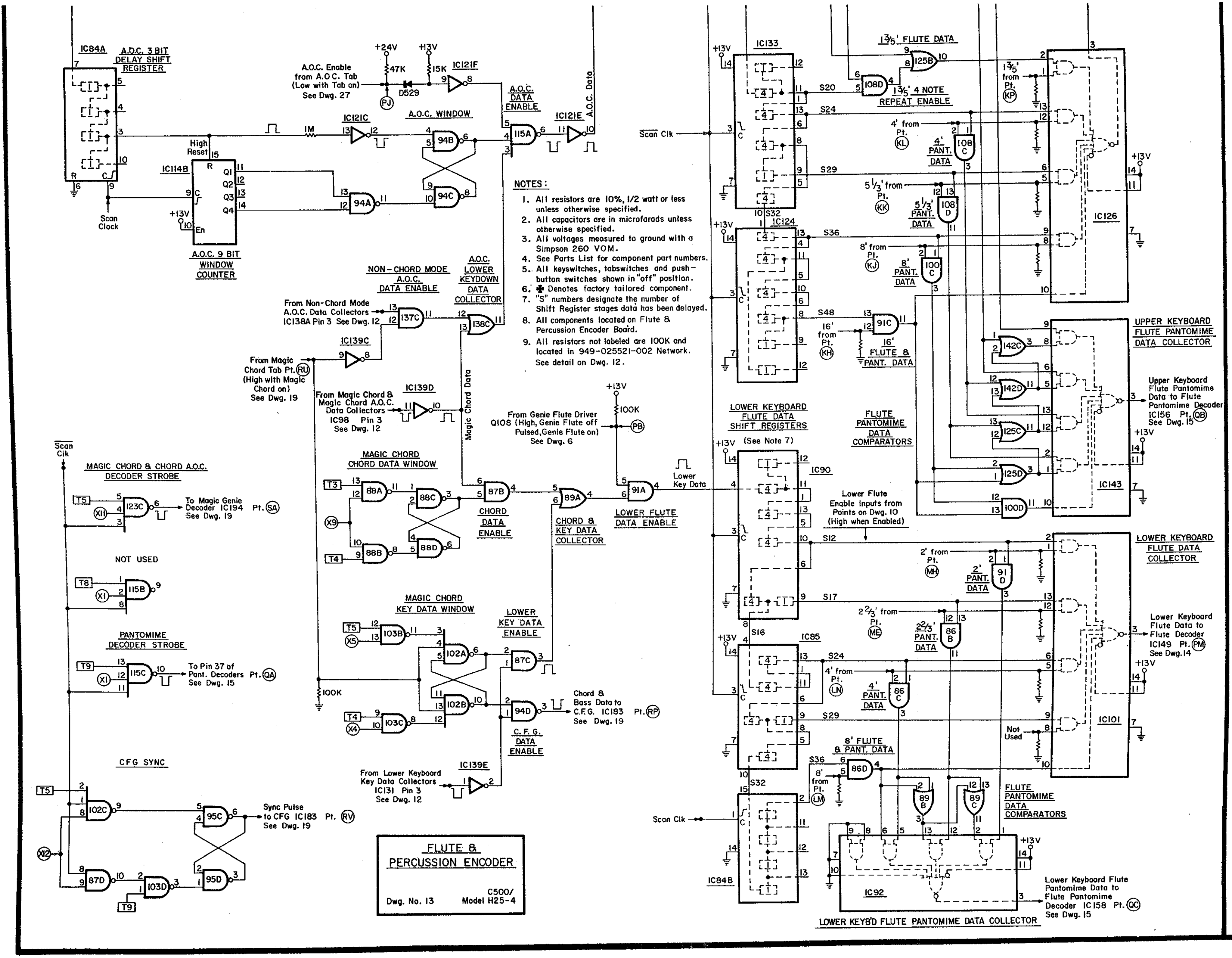
Indicates positive edge triggered device

Indicates negative edge triggered device

All other IC'S: Pin 14 = +13V, Pin 7 = Gnd, Unless otherwise specified

IC84 & IC114: Pin 16 = +13V, Pin 8 = Gnd

SCHEMATIC 13


IC84A
A.O.C. 3 BIT DELAY SHIFT REGISTER
Scan Clock
IC114B
A.O.C. 9 BIT WINDOW COUNTER
High Reset
A.O.C. Enable from A.O.C. Tab (Low with Tab on) See Dwg. 27
PJ
D529
IC121F
IC121C
A.O.C. WINDOW
94A
94B
94C
115A
A.O.C. DATA ENABLE
IC121E
A.O.C. Data
NON-CHORD MODE A.O.C. DATA ENABLE
From Non-Chord Mode A.O.C. Data Collectors IC138A Pin 3 See Dwg. 12
137C
138C
A.O.C. LOWER KEYDOWN DATA COLLECTOR
IC139C
From Magic Chord Tab Pt. RU (High with Magic Chord on) See Dwg. 19
IC139D
From Magic Chord & Magic Chord A.O.C. Data Collectors IC98 Pin 3 See Dwg. 12
Magic Chord Data
MAGIC CHORD CHORD DATA WINDOW
88A
88B
88C
88D
87B
CHORD DATA ENABLE
89A
CHORD & KEY DATA COLLECTOR
From Genie Flute Driver Q108 (High, Genie Flute off Pulsed, Genie Flute on) See Dwg. 6
PB
91A
LOWER FLUTE DATA ENABLE
Lower Key Data
MAGIC CHORD KEY DATA WINDOW
103B
103C
102A
102B
87C
LOWER KEY DATA ENABLE
94D
C.F.G. DATA ENABLE
Chord & Bass Data to C.F.G. IC183 See Dwg. 19 Pt. RP
IC139E
From Lower Keyboard Key Data Collectors IC131 Pin 3 See Dwg. 12
Scan Clk
MAGIC CHORD & CHORD A.O.C. DECODER STROBE
123C
To Magic Genie Decoder IC194 See Dwg. 19 Pt. SA
NOT USED
115B
PANTOMIME DECODER STROBE
115C
To Pin 37 of Pant. Decoders See Dwg. 15 Pt. QA
CFG SYNC
102C
87D
103D
95C
95D
Sync Pulse to CFG IC183 See Dwg. 19 Pt. RV
IC133
IC124
IC90
IC85
IC84B
LOWER KEYBOARD FLUTE DATA SHIFT REGISTERS (See Note 7)
1 3/5' FLUTE DATA
125B
108D
1 3/5' 4 NOTE REPEAT ENABLE
1 3/5' from Pt. KP
4' from Pt. KL
4' PANT. DATA
108C
5 1/3' from Pt. KK
5 1/3' PANT. DATA
108D
8' from Pt. KJ
8' PANT. DATA
100C
16' from Pt. KH
91C
16' FLUTE & PANT. DATA
IC126
IC143
UPPER KEYBOARD FLUTE PANTOMIME DATA COLLECTOR
142C
142D
125C
125D
100D
Upper Keyboard Flute Pantomime Data to Flute Pantomime Decoder IC156 Pt. QB See Dwg. 15
FLUTE PANTOMIME DATA COMPARATORS
Lower Flute Enable Inputs from Points on Dwg. 10 (High when Enabled)
IC101
LOWER KEYBOARD FLUTE DATA COLLECTOR
2' from Pt. MH
2' PANT. DATA
91D
2 2/3' from Pt. ME
2 2/3' PANT. DATA
86B
4' from Pt. LN
4' PANT. DATA
86C
Not Used
Lower Keyboard Flute Data to Flute Decoder IC149 Pt. PM See Dwg. 14
8' FLUTE & PANT. DATA
8' from Pt. LM
86D
89B
89C
FLUTE PANTOMIME DATA COMPARATORS
IC92
LOWER KEYB'D FLUTE PANTOMIME DATA COLLECTOR
Lower Keyboard Flute Pantomime Data to Flute Pantomime Decoder IC158 Pt. QC See Dwg. 15
+13V
+24V
47K
15K
1M
100K
S12
S16
S17
S20
S24
S29
S32
S36
S48

NOTES:

1. All resistors are 10%, 1/2 watt or less unless otherwise specified.
2. All capacitors are in microfarads unless otherwise specified.
3. All voltages measured to ground with a Simpson 260 VOM.
4. See Parts List for component part numbers.
5. All keyswitches, tabswitches and push-button switches shown in "off" position.
6. ✤ Denotes factory tailored component.
7. "S" numbers designate the number of Shift Register stages data has been delayed.
8. All components located on Flute & Percussion Encoder Board.
9. All resistors not labeled are 100K and located in 949-025521-002 Network. See detail on Dwg. 12.

FLUTE & PERCUSSION ENCODER

Dwg. No. 13

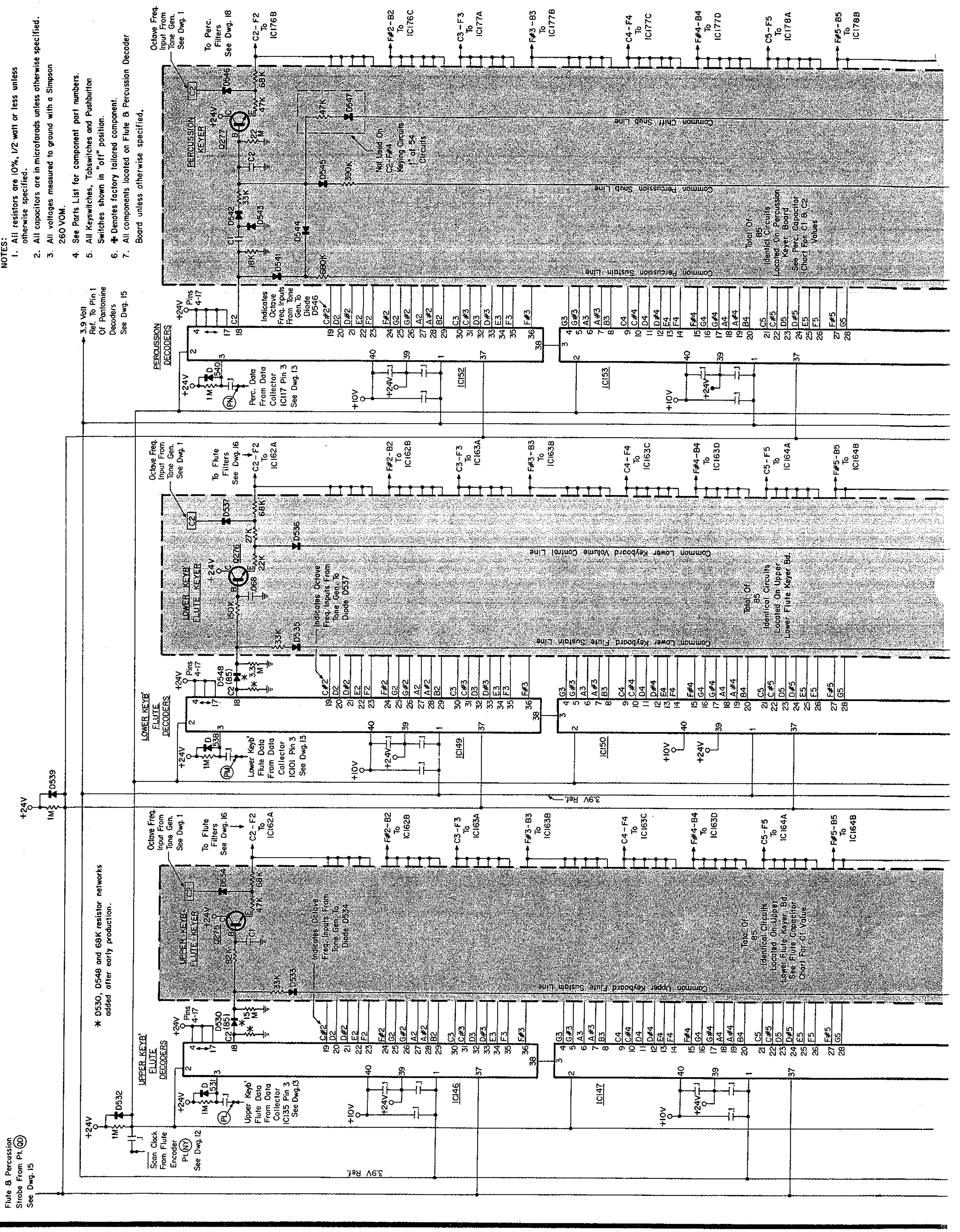
C500/
Model H25-4

SCHEMATIC 14

NOTES:

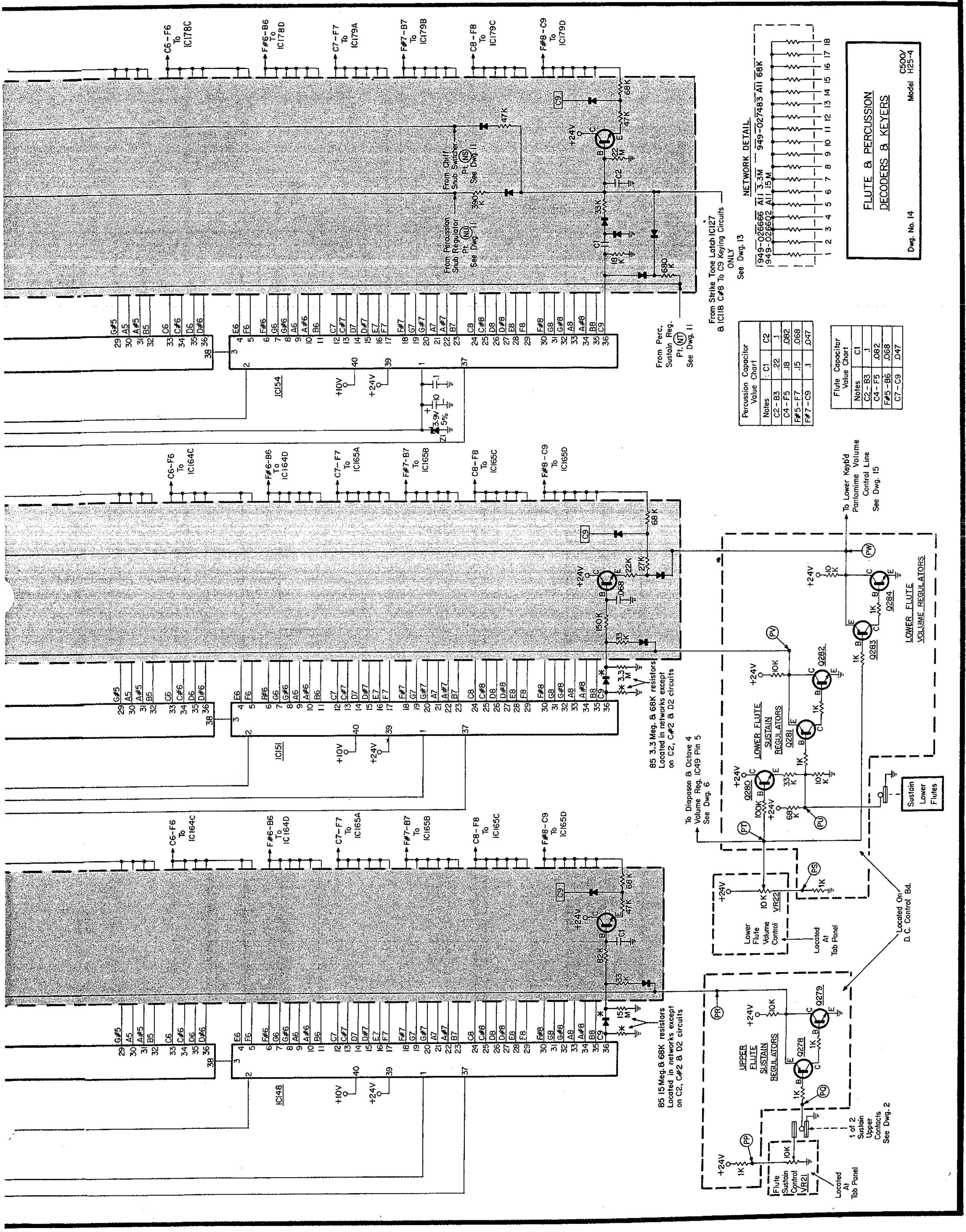
1. All resistors are 10%, 1/2 watt or less unless otherwise specified.
2. All capacitors are in microfarads unless otherwise specified.
3. All voltages measured to ground with a Simpson 260 VOM.
4. See Parts List for component part numbers.
5. All Keyswitches, Tabswitches and Pushbutton Switches shown in "off" position.
6. ✱ Denotes factory tailored component.
7. All components located on Flute & Percussion Decoder Board unless otherwise specified.

✱ D530, D548 and 68K resistor networks added after early production.



PERCUSSION DECODERS
PERCUSSION KEYER
Q277
IC152
IC153
LOWER KEYB' FLUTE DECODERS
LOWER KEYB' FLUTE KEYER
Q276
IC149
IC150
UPPER KEYB' FLUTE DECODERS
UPPER KEYB' FLUTE KEYER
Q275
IC146
IC147
Octave Freq. Input From Tone Gen. See Dwg. 1
To Perc. Filters See Dwg. 18
To Flute Filters See Dwg. 16
C2-F2 To IC176B
F#2-B2 To IC176C
C3-F3 To IC177A
F#3-B3 To IC177B
C4-F4 To IC177C
F#4-B4 To IC177D
C5-F5 To IC178A
F#5-B5 To IC178B
C2-F2 To IC162A
F#2-B2 To IC162B
C3-F3 To IC163A
F#3-B3 To IC163B
C4-F4 To IC163C
F#4-B4 To IC163D
C5-F5 To IC164A
F#5-B5 To IC164B
Common Chiff Snub Line
Common Percussion Snub Line
Common Percussion Sustain Line
Common Lower Keyboard Volume Control Line
Common Lower Keyboard Flute Sustain Line
Common Upper Keyboard Flute Sustain Line
Not Used On C2-F#4 Keying Circuits (1 of 54 Circuits)
Total Of 85 Identical Circuits Located On Percussion Keyer Board. See Perc. Capacitor Chart For C1 & C2 Values
Total Of 85 Identical Circuits Located On Upper Lower Flute Keyer Bd.
Total Of 85 Identical Circuits Located On Upper Lower Flute Keyer Bd. See Flute Capacitor Chart For C1 Value.
Indicates Octave Freq. Inputs From Tone Gen. To Diode D546
Indicates Octave Freq. Inputs From Tone Gen. To Diode D537
Indicates Octave Freq. Inputs From Tone Gen. To Diode D534
3.9 Volt Ref. To Pin 1 Of Pantomine Decoders See Dwg. 15
Perc. Data From Data Collector IC117 Pin 3 See Dwg. 13
Lower Keyb' Flute Data From Data Collector IC101 Pin 3 See Dwg. 13
Upper Keyb' Flute Data From Data Collector IC135 Pin 3 See Dwg. 13
Scan Clock From Flute Encoder Pt. NY See Dwg. 12
Flute & Percussion Strobe From Pt. QD See Dwg. 15
3.9V Ref.
+24V
+10V
Pins 4-17
D530 D531 D532 D533 D534 D535 D536 D537 D538 D539 D540 D541 D542 D543 D544 D545 D546 D547 D548
PN
PL
1M 18K 33K 390K 390K 47K 68K 22K 27K 150K 82K 3.3M
.068
C1 C2
C2 D2 D#2 E2 F2 F#2 G2 G#2 A2 A#2 B2 C3 C#3 D3 D#3 E3 F3 F#3
G3 G#3 A3 A#3 B3 C4 C#4 D4 D#4 E4 F4 F#4 G4 G#4 A4 A#4 B4 C5 C#5 D5 D#5 E5 F5 F#5 G5

SCHEMATIC 14



C6-F6 To IC178C
F#6-B6 To IC178D
C7-F7 To IC179A
F#7-B7 To IC179B
C8-F8 To IC179C
F#8-C9 To IC179D
From Chiff Snub Switcher Pt. NS See Dwg. 11
From Percussion Snub Regulator Pt. NU See Dwg. 11
From Perc. Sustain Reg. Pt. NT See Dwg. 11
From Strike Tone Latch IC127 & IC118 C#8 To C9 Keying Circuits ONLY See Dwg. 13
IC154
IC151
IC148
+10V
+24V
Z1 3.9V 5%
C6-F6 To IC164C
F#6-B6 To IC164D
C7-F7 To IC165A
F#7-B7 To IC165B
C8-F8 To IC165C
F#8-C9 To IC165D
85 3.3 Meg. & 68K resistors Located in networks except on C2, C#2 & D2 circuits
85 15 Meg. & 68K resistors Located in networks except on C2, C#2 & D2 circuits
To Diapason & Octave 4 Volume Reg. IC49 Pin 5 See Dwg. 6
To Lower Keyb'd Pantomime Volume Control Line See Dwg. 15
LOWER FLUTE VOLUME REGULATORS
LOWER FLUTE SUSTAIN REGULATORS
UPPER FLUTE SUSTAIN REGULATORS
Q278
Q279
Q280
Q281
Q282
Q283
Q284
Lower Flute Volume Control VR22
Located At Tab Panel
Located On D.C. Control Bd.
Sustain Lower Flutes
1 of 2 Sustain Upper Contacts See Dwg. 2
Flute Sustain Control VR21
Located At Tab Panel
NETWORK DETAIL
949-026666 All 3.3M
949-026602 All 15M
949-027483 All 68K
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
FLUTE & PERCUSSION DECODERS & KEYERS
Dwg. No. 14
C500/ H25-4 Model

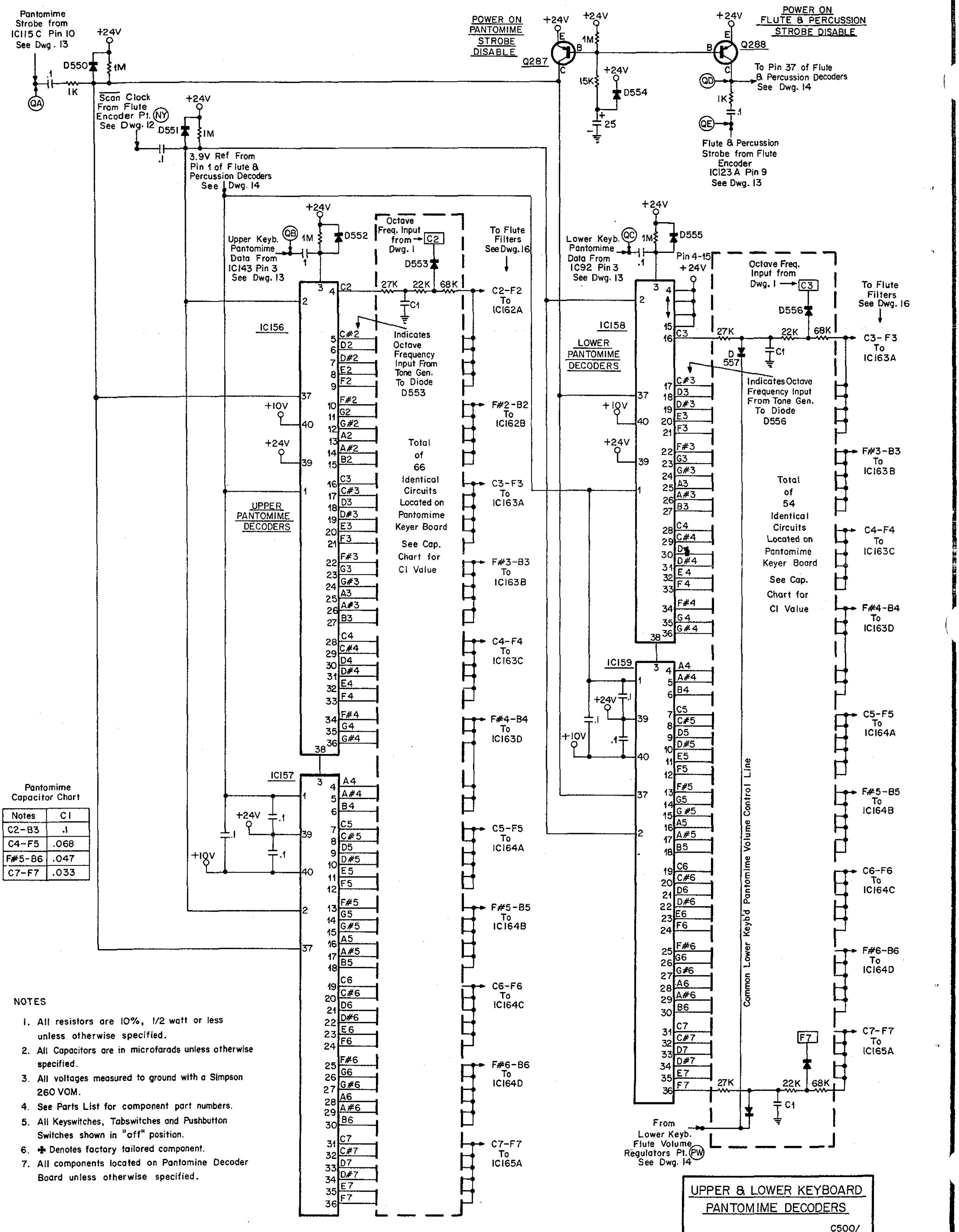
Percussion Capacitor Value Chart

Notes	C1	C2
C2-B3	.22	.1
C4-F5	.18	.082
F#5-F7	.15	.068
F#7-C9	.1	.047

Flute Capacitor Value Chart

Notes	C1
C2-B3	.1
C4-F5	.082
F#5-B6	.068
C7-C9	.047

SCHEMATIC 15


Pantomime Strobe from IC115C Pin 10 See Dwg. 13
+24V
D550
1M
.1
1K
QA
Scan Clock From Flute Encoder Pt. NY See Dwg. 12
+24V
D551
1M
.1
3.9V Ref From Pin 1 of Flute & Percussion Decoders See Dwg. 14
POWER ON PANTOMIME STROBE DISABLE
Q287
+24V
+24V
1M
15K
+24V
D554
25
POWER ON FLUTE & PERCUSSION STROBE DISABLE
+24V
Q288
To Pin 37 of Flute & Percussion Decoders See Dwg. 14
QD
1K
.1
QE
Flute & Percussion Strobe from Flute Encoder IC123A Pin 9 See Dwg. 13
+24V
Upper Keyb. Pantomime Data From IC143 Pin 3 See Dwg. 13
QB
1M
D552
.1
Octave Freq. Input from C2 Dwg. 1
D553
27K
22K
68K
C1
To Flute Filters See Dwg. 16
C2-F2 To IC162A
IC156
Indicates Octave Frequency Input From Tone Gen. To Diode D553
F#2-B2 To IC162B
+10V
+24V
Total of 66 Identical Circuits Located on Pantomime Keyer Board
See Cap. Chart for C1 Value
C3-F3 To IC163A
UPPER PANTOMIME DECODERS
F#3-B3 To IC163B
C4-F4 To IC163C
F#4-B4 To IC163D
IC157
+24V
+10V
C5-F5 To IC164A
F#5-B5 To IC164B
C6-F6 To IC164C
F#6-B6 To IC164D
C7-F7 To IC165A
C2 C#2 D2 D#2 E2 F2 F#2 G2 G#2 A2 A#2 B2 C3 C#3 D3 D#3 E3 F3 F#3 G3 G#3 A3 A#3 B3 C4 C#4 D4 D#4 E4 F4 F#4 G4 G#4
A4 A#4 B4 C5 C#5 D5 D#5 E5 F5 F#5 G5 G#5 A5 A#5 B5 C6 C#6 D6 D#6 E6 F6 F#6 G6 G#6 A6 A#6 B6 C7 C#7 D7 D#7 E7 F7
+24V
Lower Keyb. Pantomime Data From IC92 Pin 3 See Dwg. 13
QC
1M
D555
.1
Pin 4-15 +24V
Octave Freq. Input from Dwg. 1 C3
D556
IC158
LOWER PANTOMIME DECODERS
27K
22K
68K
D557
C1
Indicates Octave Frequency Input From Tone Gen. To Diode D556
To Flute Filters See Dwg. 16
C3-F3 To IC163A
+10V
+24V
F#3-B3 To IC163B
Total of 54 Identical Circuits Located on Pantomime Keyer Board
See Cap. Chart for C1 Value
C4-F4 To IC163C
F#4-B4 To IC163D
IC159
+24V
.1
+10V
C5-F5 To IC164A
F#5-B5 To IC164B
Common Lower Keyb'd Pantomime Volume Control Line
C6-F6 To IC164C
F#6-B6 To IC164D
F7
C7-F7 To IC165A
27K
22K
68K
C1
From Lower Keyb. Flute Volume Regulators Pt. PW See Dwg. 14
C3 C#3 D3 D#3 E3 F3 F#3 G3 G#3 A3 A#3 B3 C4 C#4 D4 D#4 E4 F4 F#4 G4 G#4
A4 A#4 B4 C5 C#5 D5 D#5 E5 F5 F#5 G5 G#5 A5 A#5 B5 C6 C#6 D6 D#6 E6 F6 F#6 G6 G#6 A6 A#6 B6 C7 C#7 D7 D#7 E7 F7

Pantomime Capacitor Chart

Notes	C1
C2-B3	.1
C4-F5	.068
F#5-B6	.047
C7-F7	.033

NOTES

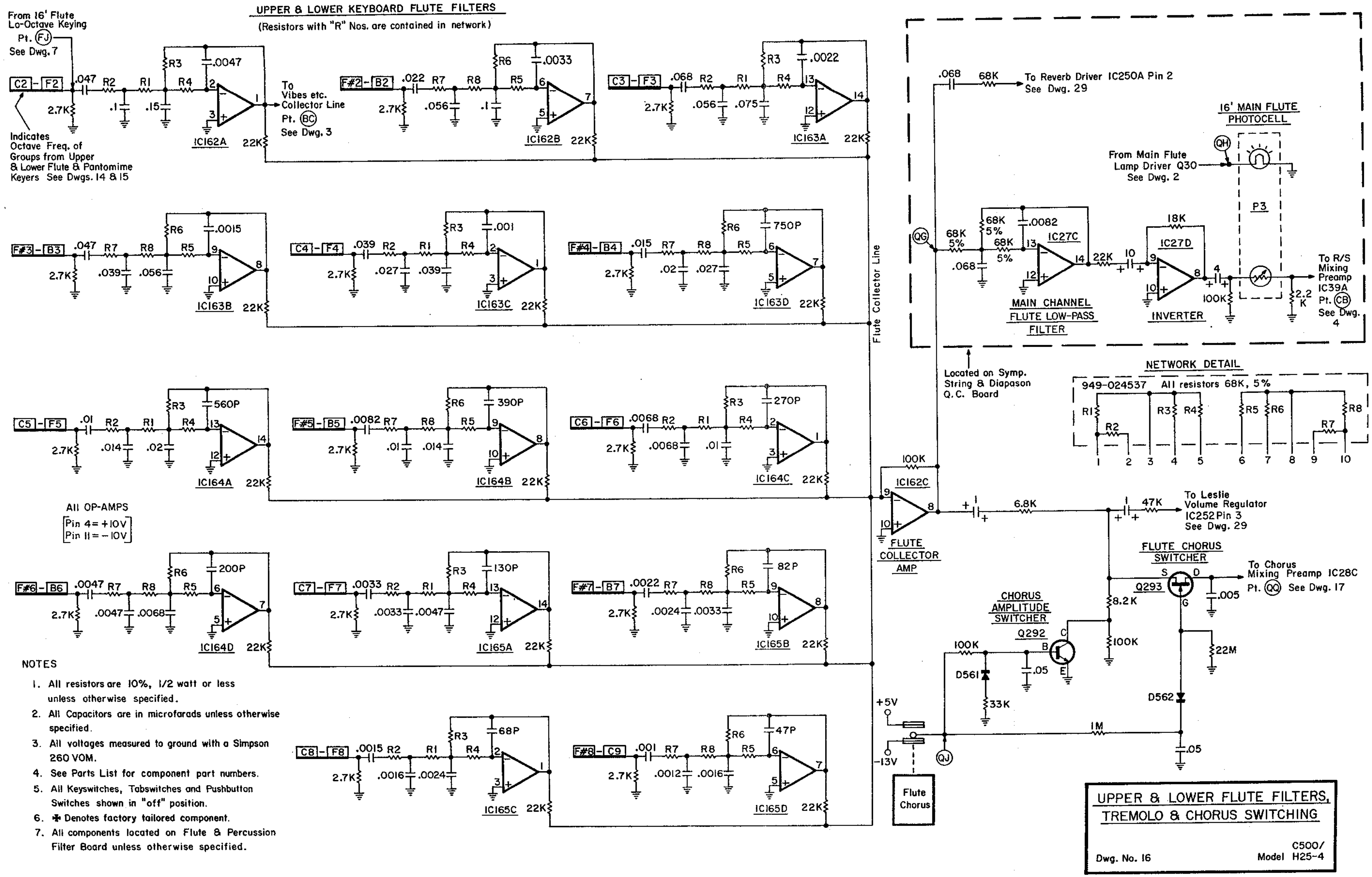
1. All resistors are 10%, 1/2 watt or less unless otherwise specified.
2. All Capacitors are in microfarads unless otherwise specified.
3. All voltages measured to ground with a Simpson 260 VOM.
4. See Parts List for component part numbers.
5. All Keyswitches, Tabswitches and Pushbutton Switches shown in "off" position.
6. ✣ Denotes factory tailored component.
7. All components located on Pantomine Decoder Board unless otherwise specified.

UPPER & LOWER KEYBOARD PANTOMIME DECODERS

Dwg. No. 15

C500/
Model H25-4

SCHEMATIC 16


UPPER & LOWER KEYBOARD FLUTE FILTERS
(Resistors with "R" Nos. are contained in network)
From 16' Flute Lo-Octave Keying Pt. FJ See Dwg. 7
Indicates Octave Freq. of Groups from Upper & Lower Flute & Pantomime Keyers See Dwgs. 14 & 15
C2-F2
F#2-B2
C3-F3
F#3-B3
C4-F4
F#4-B4
C5-F5
F#5-B5
C6-F6
F#6-B6
C7-F7
F#7-B7
C8-F8
F#8-C9
IC162A
IC162B
IC163A
IC163B
IC163C
IC163D
IC164A
IC164B
IC164C
IC164D
IC165A
IC165B
IC165C
IC165D
R1
R2
R3
R4
R5
R6
R7
R8
2.7K
22K
.047
.0047
.0033
.0022
.0015
.001
750P
560P
390P
270P
200P
130P
82P
68P
47P
To Vibes etc. Collector Line Pt. BC See Dwg. 3
Flute Collector Line
All OP-AMPS
Pin 4 = +10V
Pin 11 = -10V
.068
68K
To Reverb Driver IC250A Pin 2 See Dwg. 29
16' MAIN FLUTE PHOTOCELL
QH
From Main Flute Lamp Driver Q30 See Dwg. 2
P3
QG
68K 5%
.0082
IC27C
MAIN CHANNEL FLUTE LOW-PASS FILTER
22K
10
18K
IC27D
INVERTER
4
100K
2.2 K
To R/S Mixing Preamp IC39A Pt. CB See Dwg. 4
Located on Symp. String & Diapason Q.C. Board
NETWORK DETAIL
949-024537 All resistors 68K, 5%
1 2 3 4 5 6 7 8 9 10
100K
IC162C
FLUTE COLLECTOR AMP
6.8K
47K
To Leslie Volume Regulator IC252 Pin 3 See Dwg. 29
FLUTE CHORUS SWITCHER
Q293
S D G
To Chorus Mixing Preamp IC28C Pt. QQ See Dwg. 17
.005
8.2K
22M
CHORUS AMPLITUDE SWITCHER
Q292
C B E
.05
D561
33K
D562
1M
+5V
-13V
QJ
Flute Chorus

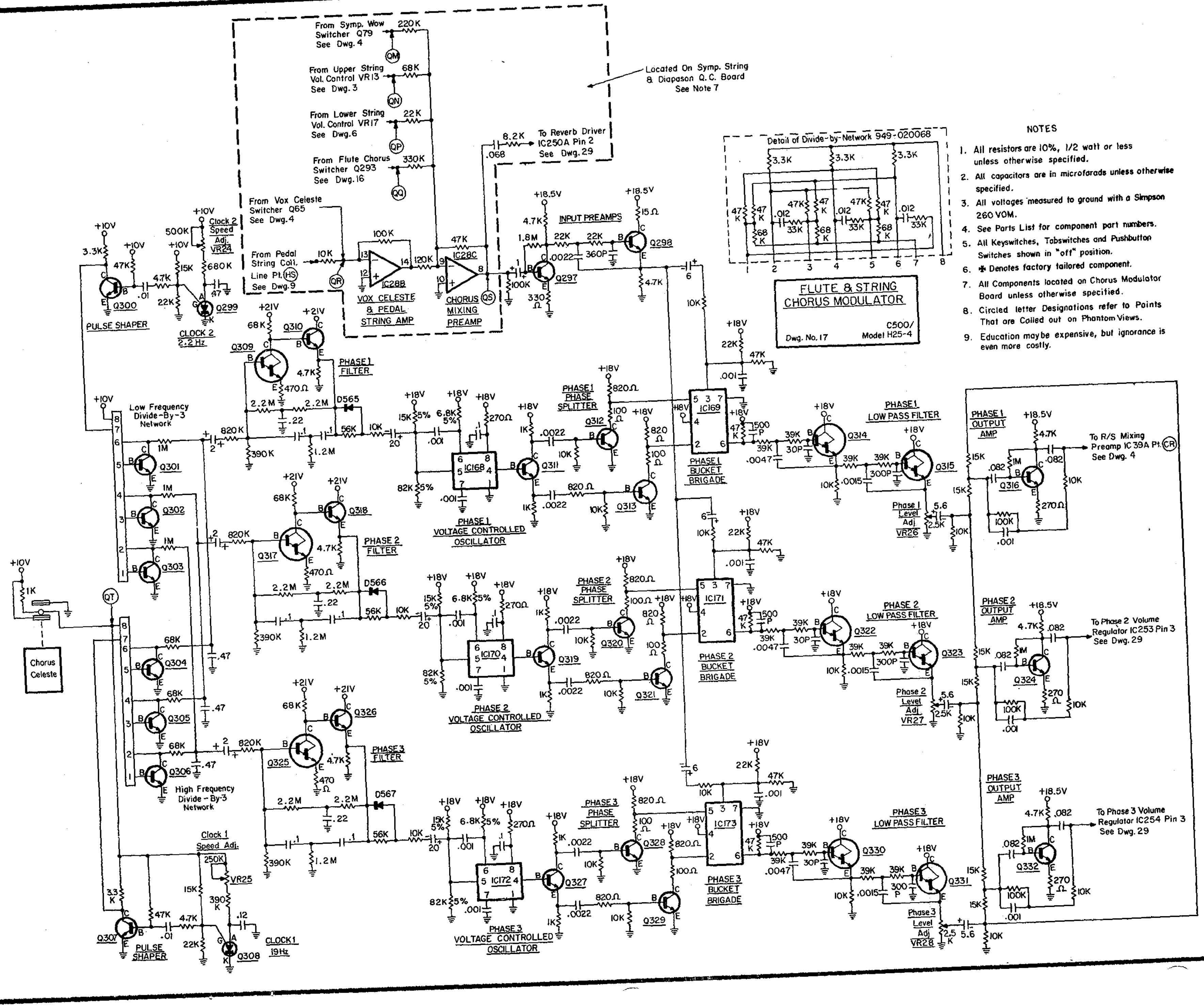
NOTES

1. All resistors are 10%, 1/2 watt or less unless otherwise specified.
2. All Capacitors are in microfarads unless otherwise specified.
3. All voltages measured to ground with a Simpson 260 VOM.
4. See Parts List for component part numbers.
5. All Keyswitches, Tabswitches and Pushbutton Switches shown in "off" position.
6. ✚ Denotes factory tailored component.
7. All components located on Flute & Percussion Filter Board unless otherwise specified.

UPPER & LOWER FLUTE FILTERS,
TREMOLO & CHORUS SWITCHING

Dwg. No. 16
C500/
Model H25-4

SCHEMATIC 17


From Symp. Wow Switcher Q79 See Dwg. 4
From Upper String Vol. Control VR13 See Dwg. 3
From Lower String Vol. Control VR17 See Dwg. 6
From Flute Chorus Switcher Q293 See Dwg. 16
From Vox Celeste Switcher Q65 See Dwg. 4
From Pedal String Coil. Line Pt. (HS) See Dwg. 9
Located On Symp. String & Diapason Q.C. Board See Note 7
To Reverb Driver IC250A Pin 2 See Dwg. 29
VOX CELESTE & PEDAL STRING AMP
IC28B
IC28C
CHORUS MIXING PREAMP
INPUT PREAMPS
Q297
Q298
Detail of Divide-by-Network 949-020068
PULSE SHAPER
Q300
CLOCK 2 2.2 Hz
Clock 2 Speed Adj. VR24
Q299
Low Frequency Divide-By-3 Network
Q301
Q302
Q303
High Frequency Divide-By-3 Network
Q304
Q305
Q306
Chorus Celeste
Clock 1 Speed Adj. VR25
CLOCK1 19Hz
Q308
PULSE SHAPER
Q307
PHASE 1 FILTER
Q309
Q310
D565
PHASE 2 FILTER
Q317
Q318
D566
PHASE 3 FILTER
Q325
Q326
D567
PHASE 1 VOLTAGE CONTROLLED OSCILLATOR
IC168
PHASE 2 VOLTAGE CONTROLLED OSCILLATOR
IC170
PHASE 3 VOLTAGE CONTROLLED OSCILLATOR
IC172
PHASE 1 PHASE SPLITTER
Q311
Q312
Q313
PHASE 2 PHASE SPLITTER
Q319
Q320
Q321
PHASE 3 PHASE SPLITTER
Q327
Q328
Q329
PHASE 1 BUCKET BRIGADE
IC169
PHASE 2 BUCKET BRIGADE
IC171
PHASE 3 BUCKET BRIGADE
IC173
PHASE 1 LOW PASS FILTER
Q314
Q315
PHASE 2 LOW PASS FILTER
Q322
Q323
PHASE 3 LOW PASS FILTER
Q330
Q331
Phase 1 Level Adj VR26
Phase 2 Level Adj VR27
Phase 3 Level Adj VR28
PHASE 1 OUTPUT AMP
Q316
PHASE 2 OUTPUT AMP
Q324
PHASE 3 OUTPUT AMP
Q332
To R/S Mixing Preamp IC39A Pt. (CR) See Dwg. 4
To Phase 2 Volume Regulator IC253 Pin 3 See Dwg. 29
To Phase 3 Volume Regulator IC254 Pin 3 See Dwg. 29

FLUTE & STRING CHORUS MODULATOR

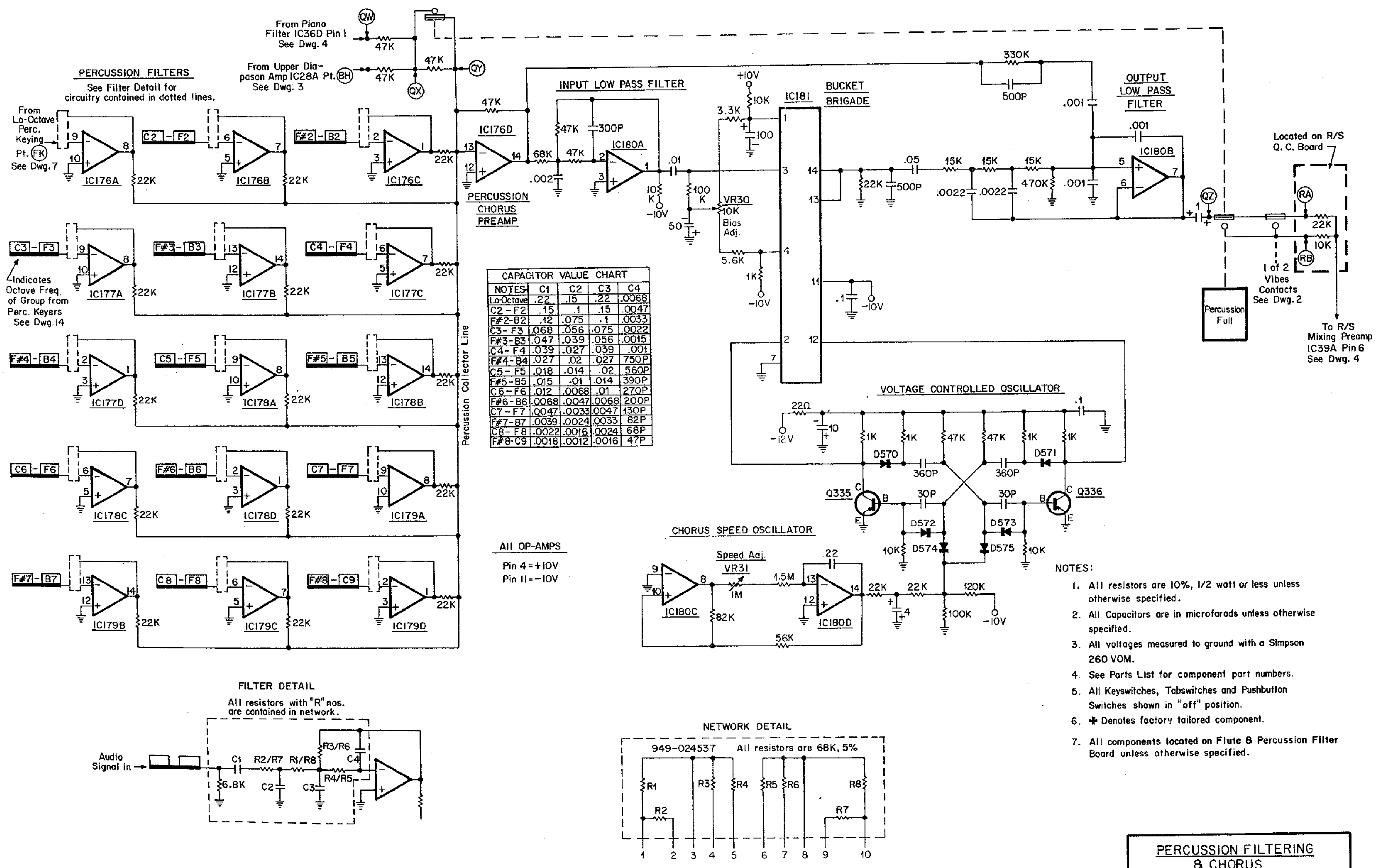
Dwg. No. 17

C500/ Model H25-4

NOTES

1. All resistors are 10%, 1/2 watt or less unless otherwise specified.
2. All capacitors are in microfarads unless otherwise specified.
3. All voltages measured to ground with a Simpson 260 VOM.
4. See Parts List for component part numbers.
5. All Keyswitches, Tabswitches and Pushbutton Switches shown in "off" position.
6. ✱ Denotes factory tailored component.
7. All Components located on Chorus Modulator Board unless otherwise specified.
8. Circled letter Designations refer to Points That are Called out on Phantom Views.
9. Education maybe expensive, but ignorance is even more costly.

SCHEMATIC 18


PERCUSSION FILTERS
See Filter Detail for circuitry contained in dotted lines.
From Lo-Octave Perc. Keying Pt. FK See Dwg. 7
From Piano Filter IC36D Pin 1 See Dwg. 4
From Upper Diapason Amp IC28A Pt. BH See Dwg. 3
QW
QX
QY
QZ
47K
22K
IC176A
IC176B
IC176C
IC176D
IC177A
IC177B
IC177C
IC177D
IC178A
IC178B
IC178C
IC178D
IC179A
IC179B
IC179C
IC179D
C2 - F2
F#2 - B2
C3 - F3
F#3 - B3
C4 - F4
F#4 - B4
C5 - F5
F#5 - B5
C6 - F6
F#6 - B6
C7 - F7
F#7 - B7
C8 - F8
F#8 - C9
Indicates Octave Freq. of Group from Perc. Keyers See Dwg. 14
Percussion Collector Line
PERCUSSION CHORUS PREAMP
INPUT LOW PASS FILTER
IC180A
68K
.002
300P
.01
10K
-10V
100K
50
VR30 10K Bias Adj.
3.3K
+10V
100
5.6K
1K
IC181
BUCKET BRIGADE
.1
.05
15K
500P
.0022
470K
.001
330K
OUTPUT LOW PASS FILTER
IC180B
Located on R/S Q.C. Board
RA
RB
10K
1 of 2 Vibes Contacts See Dwg. 2
Percussion Full
To R/S Mixing Preamp IC39A Pin 6 See Dwg. 4
VOLTAGE CONTROLLED OSCILLATOR
22Ω
-12V
10
1K
360P
30P
D570
D571
D572
D573
D574
D575
Q335
Q336
CHORUS SPEED OSCILLATOR
Speed Adj. VR31 1M
IC180C
IC180D
1.5M
82K
56K
.22
120K
100K
4
All OP-AMPS
Pin 4 = +10V
Pin 11 = -10V
FILTER DETAIL
All resistors with "R" nos. are contained in network.
Audio Signal in
C1
R2/R7
R1/R8
R3/R6
C4
R4/R5
C2
C3
6.8K
NETWORK DETAIL
949-024537
All resistors are 68K, 5%
R1
R2
R3
R4
R5
R6
R7
R8
1 2 3 4 5 6 7 8 9 10

CAPACITOR VALUE CHART				
NOTES	C1	C2	C3	C4
Lo-Octave	.22	.15	.22	.0068
C2 - F2	.15	.1	.15	.0047
F#2-B2	.12	.075	.1	.0033
C3 - F3	.068	.056	.075	.0022
F#3-B3	.047	.039	.056	.0015
C4 - F4	.039	.027	.039	.001
F#4-B4	.027	.02	.027	750P
C5 - F5	.018	.014	.02	560P
F#5-B5	.015	.01	.014	390P
C6 - F6	.012	.0068	.01	270P
F#6-B6	.0068	.0047	.0068	200P
C7 - F7	.0047	.0033	.0047	130P
F#7-B7	.0039	.0024	.0033	82P
C8 - F8	.0022	.0016	.0024	68P
F#8-C9	.0018	.0012	.0016	47P

NOTES:

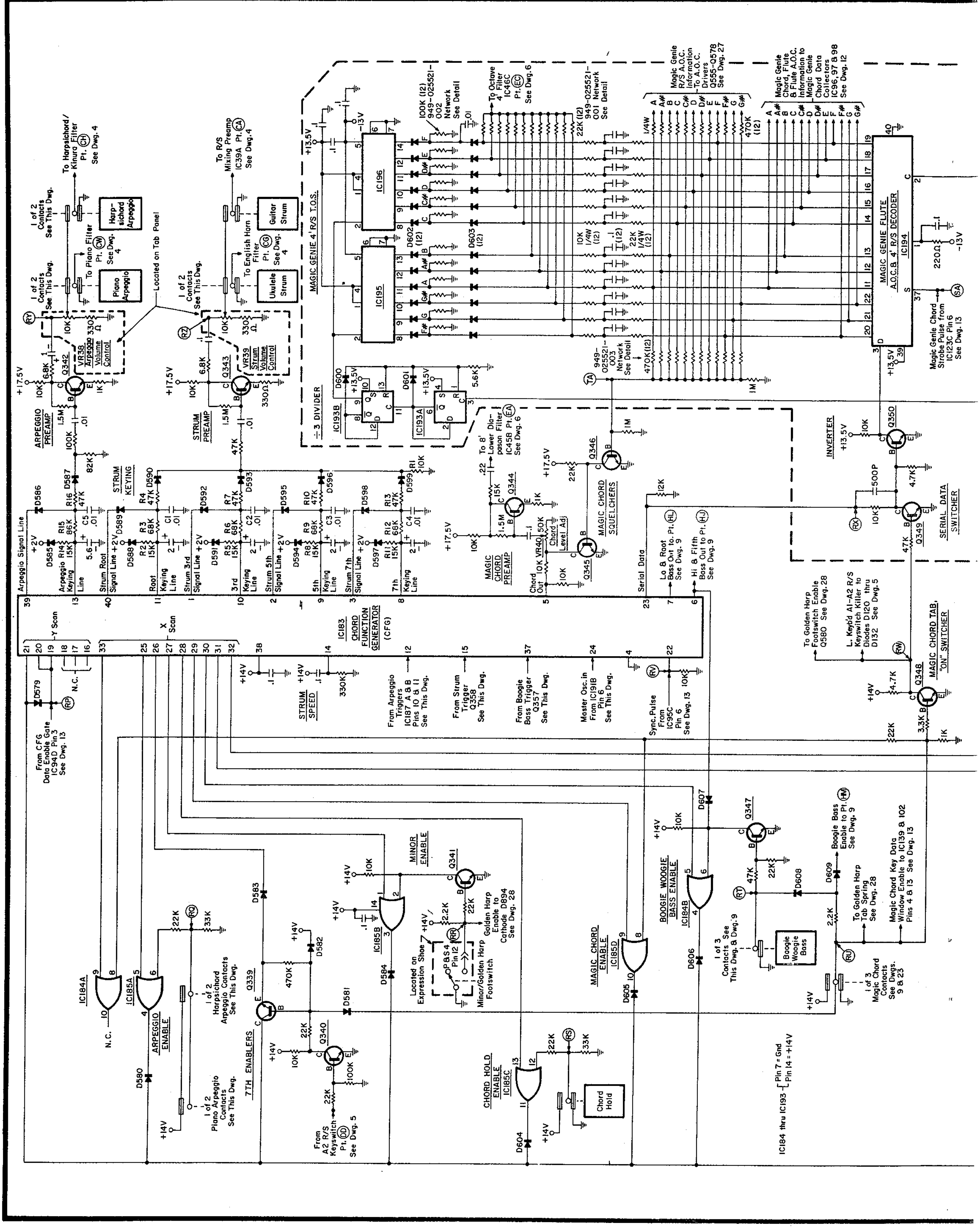
1. All resistors are 10%, 1/2 watt or less unless otherwise specified.
2. All Capacitors are in microfarads unless otherwise specified.
3. All voltages measured to ground with a Simpson 260 VOM.
4. See Parts List for component part numbers.
5. All Keyswitches, Tabswitches and Pushbutton Switches shown in "off" position.
6. ✚ Denotes factory tailored component.
7. All components located on Flute & Percussion Filter Board unless otherwise specified.

PERCUSSION FILTERING
& CHORUS

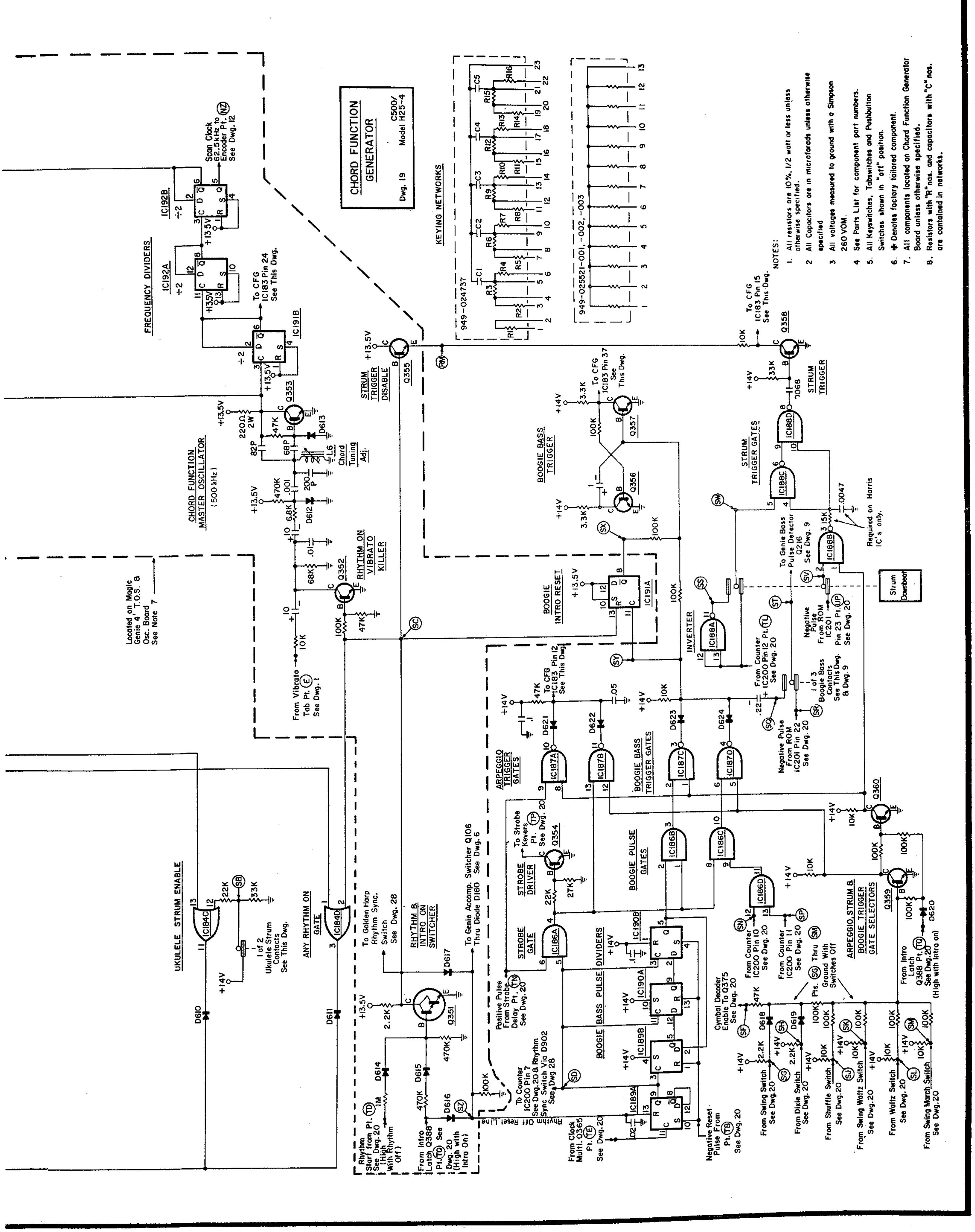
Dwg. No. 18

C500/
Model H25-4

SCHEMATIC 19


MAGIC GENIE 4' R/S T.O.S.
IC195
IC196
÷3 DIVIDER
IC193B
IC193A
MAGIC GENIE FLUTE A.O.C.& 4' R/S DECODER IC194
INVERTER
Q350
SERIAL DATA SWITCHER
Q349
MAGIC CHORD TAB "ON" SWITCHER
Q348
MAGIC CHORD SQUELCHERS
Q346
Q345
MAGIC CHORD PREAMP
Q344
Chord Level Adj
ARPEGGIO PREAMP
Q342
VR38 Arpeggio Volume Control
STRUM PREAMP
Q343
VR39 Strum Volume Control
Located on Tab Panel
Piano Arpeggio
Harpsichord Arpeggio
Ukulele Strum
Guitar Strum
STRUM KEYING
Arpeggio Signal Line
Strum Root Signal Line
Strum 3rd Signal Line
Strum 5th Signal Line
Strum 7th Signal Line
Arpeggio Keying Line
Root Keying Line
3rd Keying Line
5th Keying Line
7th Keying Line
IC183 CHORD FUNCTION GENERATOR (CFG)
Y Scan
X Scan
Chord Out
Serial Data
Lo & Root Bass Out to Pt. HL See Dwg. 9
Hi & Fifth Bass Out to Pt. HJ See Dwg. 9
STRUM SPEED
From Arpeggio Triggers IC187 A & B Pins 10 & 11 See This Dwg.
From Strum Trigger Q358 See This Dwg.
From Boogie Bass Trigger Q357 See This Dwg.
Master Osc. in From IC191B Pin 6 See This Dwg.
Sync. Pulse From IC95C Pin 6 See Dwg. 13
From CFG Data Enable Gate IC94D Pin 3 See Dwg. 13
To Golden Harp Footswitch Enable Q580 See Dwg. 28
L. Keybd A1-A2 R/S Keyswitch Killer to Diodes D120 thru D132 See Dwg. 5
Magic Genie R/S A.O.C. Information To A.O.C. Drivers Q555-Q578 See Dwg. 27
Magic Genie Chord, Flute & Flute A.O.C. Information to Magic Genie Chord Data Collectors IC96, 97 & 98 See Dwg. 12
Magic Genie Chord Strobe Pulse from IC123C Pin 6 See Dwg. 13
To Octave 4' Filter IC46C Pt. EC See Dwg. 6
To 8' Lower Diapason Filter IC45B Pt. EA See Dwg. 6
To Harpsichord/Kinura Filter Pt. CH See Dwg. 4
To Piano Filter Pt. CW See Dwg. 4
To R/S Mixing Preamp IC39A Pt. CA See Dwg. 4
To English Horn Filter Pt. CG See Dwg. 4
100K (12) 949-02552I-002 Network See Detail
22K (12) 949-02552I-001 Network See Detail
949-02552I-003 Network See Detail
MINOR ENABLE
Q341
IC185B
Located on Expression Shoe
PBS4 Pin 12
Minor/Golden Harp Footswitch
Golden Harp Enable to Cathode D894 See Dwg. 28
7TH ENABLERS
Q339
Q340
From A2 R/S Keyswitch Pt. DD See Dwg. 5
ARPEGGIO ENABLE
IC184A
IC185A
1 of 2 Harpsichord Arpeggio Contacts See This Dwg.
1 of 2 Piano Arpeggio Contacts See This Dwg.
CHORD HOLD ENABLE IC185C
Chord Hold
MAGIC CHORD ENABLE IC185D
BOOGIE WOOGIE BASS ENABLE IC184B
Q347
Boogie Woogie Bass
1 of 3 Contacts See This Dwg. & Dwg. 9
Boogie Bass Enable to Pt. HM See Dwg. 9
To Golden Harp Tab Spring See Dwg. 28
Magic Chord Key Data Window Enable to IC139 & 102 Pins 4 & 13 See Dwg. 13
1 of 3 Magic Chord Contacts See Dwgs. 9 & 23
IC184 thru IC193 - Pin 7 = Gnd, Pin 14 = +14V

SCHEMATIC 19


FREQUENCY DIVIDERS
IC192A
IC192B
IC191B
÷2
+13.5V
Scan Clock 62.5 kHz to Encoder Pt. NZ See Dwg. 12
To CFG IC183 Pin 24 See This Dwg.
CHORD FUNCTION MASTER OSCILLATOR (500 kHz)
Q353
D613
D612
220Ω 2W
82P
68P
47K
470K
6.8K
.001
200P
L6 Chord Tuning Adj.
RHYTHM ON VIBRATO KILLER
Q352
68K
10K
100K
47K
From Vibrato Tab Pt. E See Dwg. 1
Located on Magic Genie 4' T.O.S. & Osc. Board See Note 7
STRUM TRIGGER DISABLE
Q355
SC
RM
KEYING NETWORKS
949-024737
949-025521-001, -002, -003
R1 R2 R3 R4 R5 R6 R7 R8 R9 R10 R11 R12 R13 R14 R15 R16
C1 C2 C3 C4 C5
BOOGIE BASS TRIGGER
Q356
Q357
3.3K
To CFG IC183 Pin 37 See This Dwg.
SX
SY
BOOGIE INTRO RESET
IC191A
STRUM TRIGGER GATES
IC188C
IC188D
IC188B
STRUM TRIGGER
Q358
33K
.0068
To CFG IC183 Pin 15 See This Dwg.
SW
.0047
15K
Required on Harris IC's only.
To Genie Bass Pulse Detector Q216 See Dwg. 9
SV
Strum Downbeat
INVERTER
IC188A
SS
ST
From Counter IC200 Pin 12 Pt. TL See Dwg. 20
Negative Pulse From ROM IC201 Pin 23 Pt. UP See Dwg. 20
1 of 3 Boogie Bass Contacts See This Dwg. & Dwg. 9
SR
SQ
Negative Pulse From ROM IC200 Pin 22 See Dwg. 20
UKULELE STRUM ENABLE
IC184C
SB
22K
33K
1 of 2 Ukulele Strum Contacts See This Dwg.
D610
ANY RHYTHM ON GATE
IC184D
D611
ARPEGGIO TRIGGER GATES
IC187A
IC187B
To CFG IC183 Pin 12 See This Dwg.
D621
D622
BOOGIE BASS TRIGGER GATES
IC187C
IC187D
D623
D624
.05
.22
To Strobe Keyers Pt. TP See Dwg. 20
STROBE DRIVER
Q354
27K
STROBE GATE
IC186A
BOOGIE PULSE GATES
IC186B
IC186C
IC186D
Q360
Q359
ARPEGGIO, STRUM & BOOGIE TRIGGER GATE SELECTORS
D620
From Intro Latch Q388 Pt. TO See Dwg. 20 (High with Intro on)
SN
SP
From Counter IC200 Pin 10 See Dwg. 20
From Counter IC200 Pin 11 See Dwg. 20
Pts. SG Thru SM Ground With Switches Off
BOOGIE BASS PULSE DIVIDERS
IC189A
IC189B
IC190A
IC190B
SD
Positive Pulse From Strobe Delay Pt. TN See Dwg. 20
To Counter IC200 Pin 7 See Dwg. 20 & Rhythm Sync. Switch Via D902 See Dwg. 28
Rhythm Off Reset Line
From Clock Multi. Q365 Pt. TE See Dwg. 20
Negative Reset Pulse From Pt. TB See Dwg. 20
Cymbal Decoder Enable To Q375 See Dwg. 20
SF
D618
D619
SH
SG
SJ
SK
SL
SM
From Swing Switch See Dwg. 20
From Dixie Switch See Dwg. 20
From Shuffle Switch See Dwg. 20
From Swing Waltz Switch See Dwg. 20
From Waltz Switch See Dwg. 20
From Swing March Switch See Dwg. 20
RHYTHM & INTRO ON SWITCHER
Q351
D614
D615
D616
D617
SZ
2.2K
470K
1M
To Golden Harp Rhythm Sync. Switch See Dwg. 28
To Genie Accomp. Switcher Q106 Thru Diode D160 See Dwg. 6
Rhythm Start From Pt. TD See Dwg. 20 (High With Rhythm Off)
From Intro Latch Q388 Pt. TO See Dwg. 20 (High with Intro On)
+14V
+13.5V

CHORD FUNCTION GENERATOR

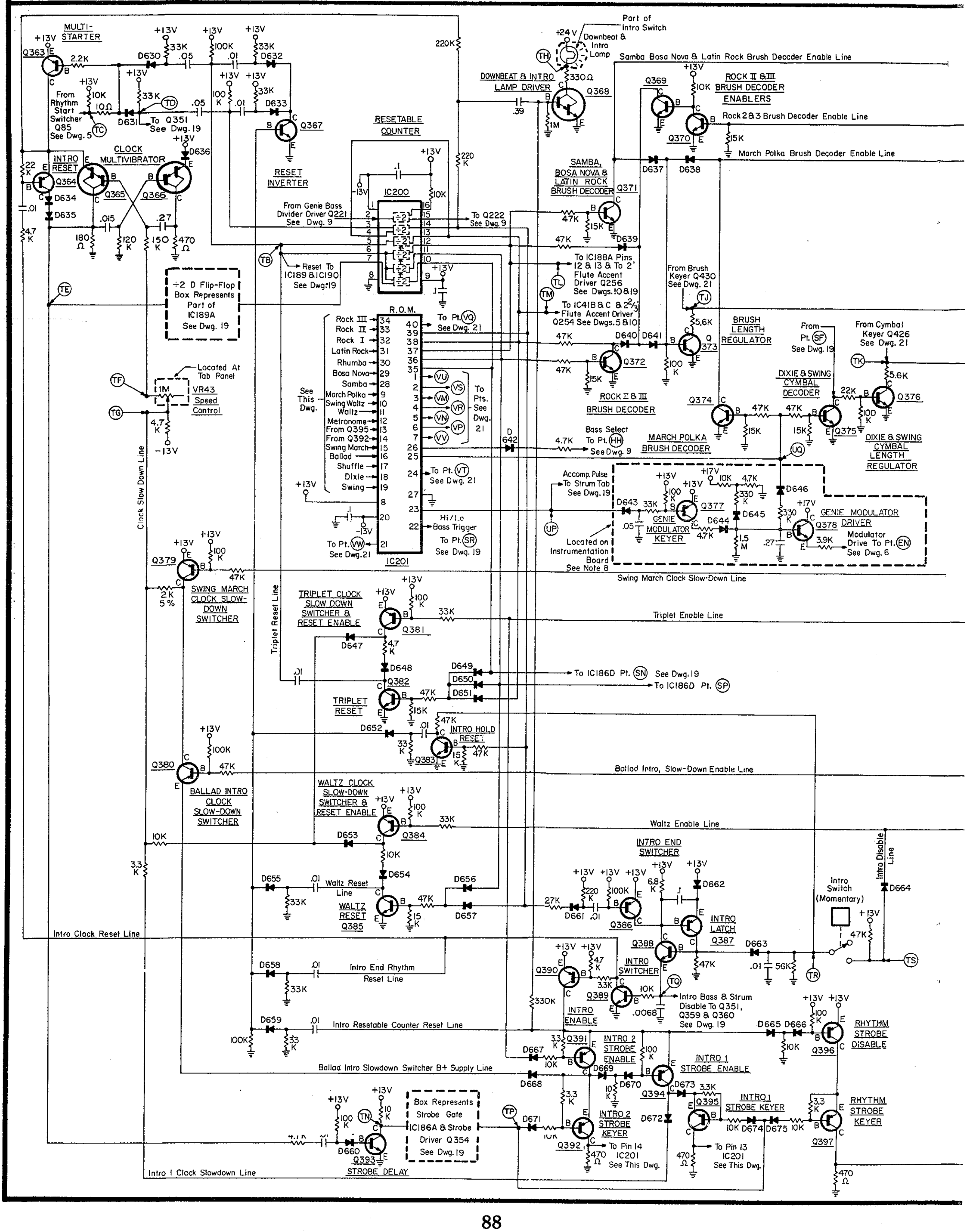
Dwg. 19

C500/ Model H25-4

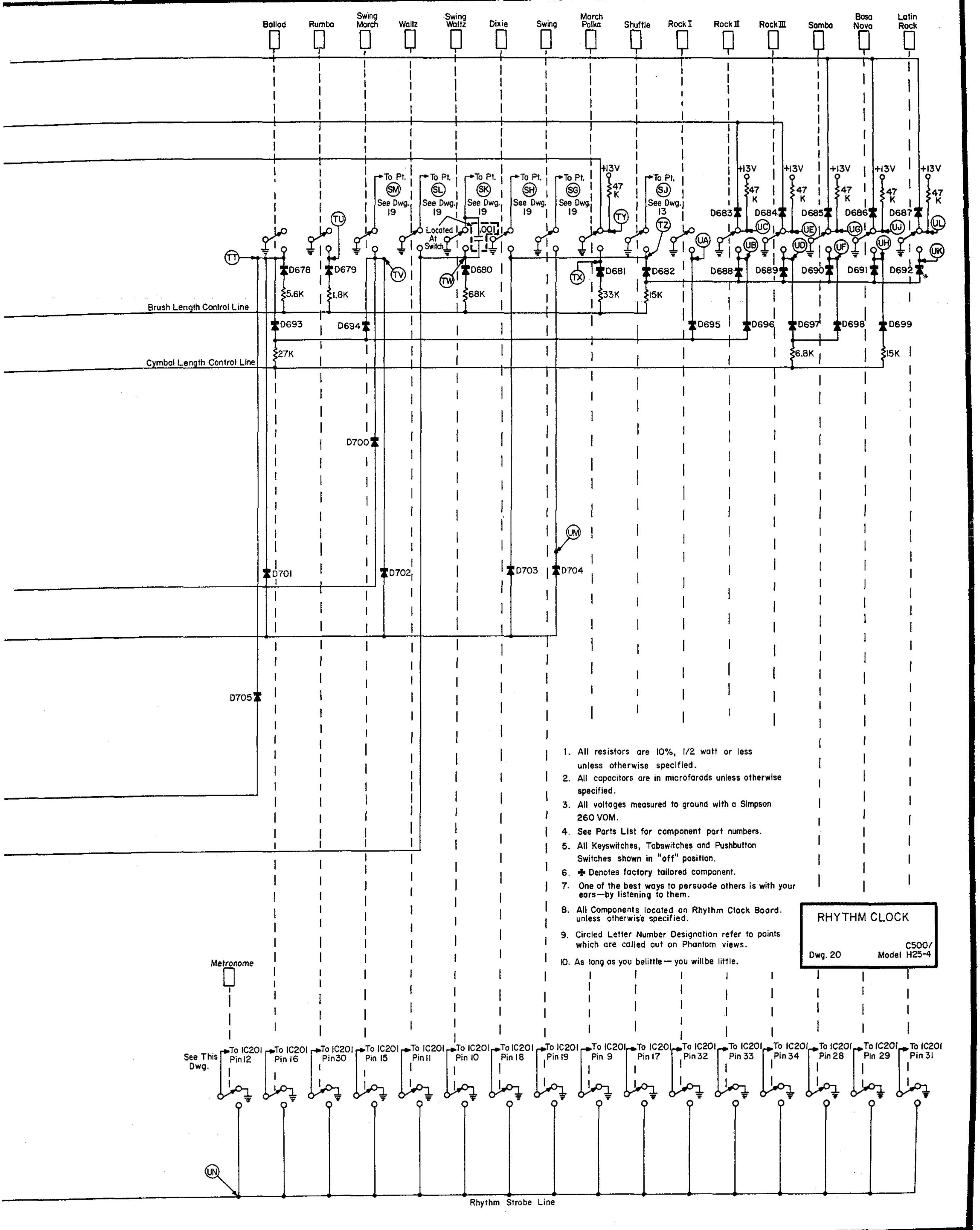
NOTES:

1. All resistors are 10%, 1/2 watt or less unless otherwise specified.
2. All Capacitors are in microfarads unless otherwise specified
3. All voltages measured to ground with a Simpson 260 VOM.
4. See Parts List for component part numbers.
5. All Keyswitches, Tabswitches and Pushbutton Switches shown in "off" position.
6. ✚ Denotes factory tailored component.
7. All components located on Chord Function Generator Board unless otherwise specified.
8. Resistors with "R" nos. and capacitors with "C" nos. are contained in networks.

SCHEMATIC 20


MULTI-STARTER
Q363
2.2K
+13V
From Rhythm Start Switcher Q85 See Dwg. 5
TC
TD
D630
D631
To Q351 See Dwg. 19
D632
D633
Q367
RESET INVERTER
D636
CLOCK MULTIVIBRATOR
INTRO RESET
Q364
Q365
Q366
D634
D635
220K
RESETABLE COUNTER
IC200
From Genie Bass Divider Driver Q221 See Dwg. 9
To Q222 See Dwg. 9
Reset To IC189 & IC190 See Dwg. 19
TB
TE
÷2 D Flip-Flop Box Represents Part of IC189A See Dwg. 19
TF
TG
Located At Tab Panel
1M VR43 Speed Control
-13V
Clock Slow Down Line
R.O.M.
IC201
Rock III
Rock II
Rock I
Latin Rock
Rhumba
Bosa Nova
Samba
March Polka
Swing Waltz
Waltz
Metronome
From Q395
From Q392
Swing March
Ballad
Shuffle
Dixie
Swing
See This Dwg.
To Pt. VQ See Dwg. 21
VU
VS
VM
VR
VN
VP
VV
To Pts. See Dwg. 21
To Pt. VT See Dwg. 21
Hi/Lo Bass Trigger To Pt. SR See Dwg. 19
To Pt. VW See Dwg. 21
Part of Intro Switch
+24V
Downbeat & Intro Lamp
TH
DOWNBEAT & INTRO LAMP DRIVER
Q368
330Ω
Samba Bosa Nova & Latin Rock Brush Deccder Enable Line
Q369
ROCK II & III BRUSH DECODER ENABLERS
Q370
Rock 2 & 3 Brush Decoder Enable Line
March Polka Brush Decoder Enable Line
D637
D638
SAMBA, BOSA NOVA & LATIN ROCK BRUSH DECODER
Q371
D639
To IC188A Pins 12 & 13 & To 2' Flute Accent Driver Q256 See Dwgs. 10 & 19
TL
TM
To IC418 B & C & 2⅔ Flute Accent Driver Q254 See Dwgs. 5 & 10
From Brush Keyer Q430 See Dwg. 21
TJ
BRUSH LENGTH REGULATOR
D640
D641
Q373
Q372
ROCK II & III BRUSH DECODER
From Pt. SF See Dwg. 19
From Cymbal Keyer Q426 See Dwg. 21
TK
DIXIE & SWING CYMBAL DECODER
Q374
Q375
Q376
DIXIE & SWING CYMBAL LENGTH REGULATOR
D642
Bass Select To Pt. HH See Dwg. 9
MARCH POLKA BRUSH DECODER
UQ
Accomp. Pulse To Strum Tab See Dwg. 19
UP
D643
GENIE MODULATOR KEYER
Q377
D644
D645
D646
GENIE MODULATOR DRIVER
Q378
Modulator Drive To Pt. EN See Dwg. 6
Located on Instrumentation Board See Note 8
Swing March Clock Slow-Down Line
Q379
SWING MARCH CLOCK SLOW-DOWN SWITCHER
Triplet Reset Line
TRIPLET CLOCK SLOW DOWN SWITCHER & RESET ENABLE
Q381
Triplet Enable Line
D647
D648
Q382
TRIPLET RESET
D649
D650
D651
To IC186D Pt. SN See Dwg. 19
To IC186D Pt. SP
D652
INTRO HOLD RESET
Q383
Q380
BALLAD INTRO CLOCK SLOW-DOWN SWITCHER
Ballad Intro, Slow-Down Enable Line
WALTZ CLOCK SLOW-DOWN SWITCHER & RESET ENABLE
Q384
Waltz Enable Line
D653
D654
D655
Waltz Reset Line
D656
D657
WALTZ RESET Q385
INTRO END SWITCHER
D661
Q386
D662
INTRO LATCH Q387
Intro Disable Line
D664
Intro Switch (Momentary)
Intro Clock Reset Line
D658
Intro End Rhythm Reset Line
Q388
INTRO SWITCHER
D663
TR
TS
Q390
Q389
TQ
Intro Bass & Strum Disable To Q351, Q359 & Q360 See Dwg. 19
INTRO ENABLE
D659
Intro Resetable Counter Reset Line
D665
D666
RHYTHM STROBE DISABLE Q396
Q391
INTRO 2 STROBE ENABLE
D667
INTRO 1 STROBE ENABLE
Ballad Intro Slowdown Switcher B+ Supply Line
D668
D669
D670
Q394
D673
D672
Q395
INTRO 1 STROBE KEYER
D674
D675
RHYTHM STROBE KEYER Q397
TN
TP
D671
Q392
INTRO 2 STROBE KEYER
To Pin 14 IC201 See This Dwg.
To Pin 13 IC201 See This Dwg.
D660
Q393
STROBE DELAY
Box Represents Strobe Gate IC186A & Strobe Driver Q354 See Dwg. 19
Intro 1 Clock Slowdown Line

SCHEMATIC 20



Ballad
Rumba
Swing March
Waltz
Swing Waltz
Dixie
Swing
March Polka
Shuffle
Rock I
Rock II
Rock III
Samba
Bosa Nova
Latin Rock
+13V
47 K
To Pt. SM See Dwg. 19
To Pt. SL See Dwg. 19
To Pt. SK See Dwg. 19
To Pt. SH See Dwg. 19
To Pt. SG See Dwg. 19
To Pt. SJ See Dwg. 13
Located At Switch
.001
TT
TU
TV
TW
TX
TY
TZ
UA
UB
UC
UD
UE
UF
UG
UH
UJ
UK
UL
UM
UN
D678
D679
D680
D681
D682
D683
D684
D685
D686
D687
D688
D689
D690
D691
D692
D693
D694
D695
D696
D697
D698
D699
D700
D701
D702
D703
D704
D705
5.6K
1.8K
68K
33K
15K
27K
6.8K
15K
Brush Length Control Line
Cymbal Length Control Line
Metronome
See This Dwg.
To IC201 Pin 12
To IC201 Pin 16
To IC201 Pin 30
To IC201 Pin 15
To IC201 Pin 11
To IC201 Pin 10
To IC201 Pin 18
To IC201 Pin 19
To IC201 Pin 9
To IC201 Pin 17
To IC201 Pin 32
To IC201 Pin 33
To IC201 Pin 34
To IC201 Pin 28
To IC201 Pin 29
To IC201 Pin 31
Rhythm Strobe Line

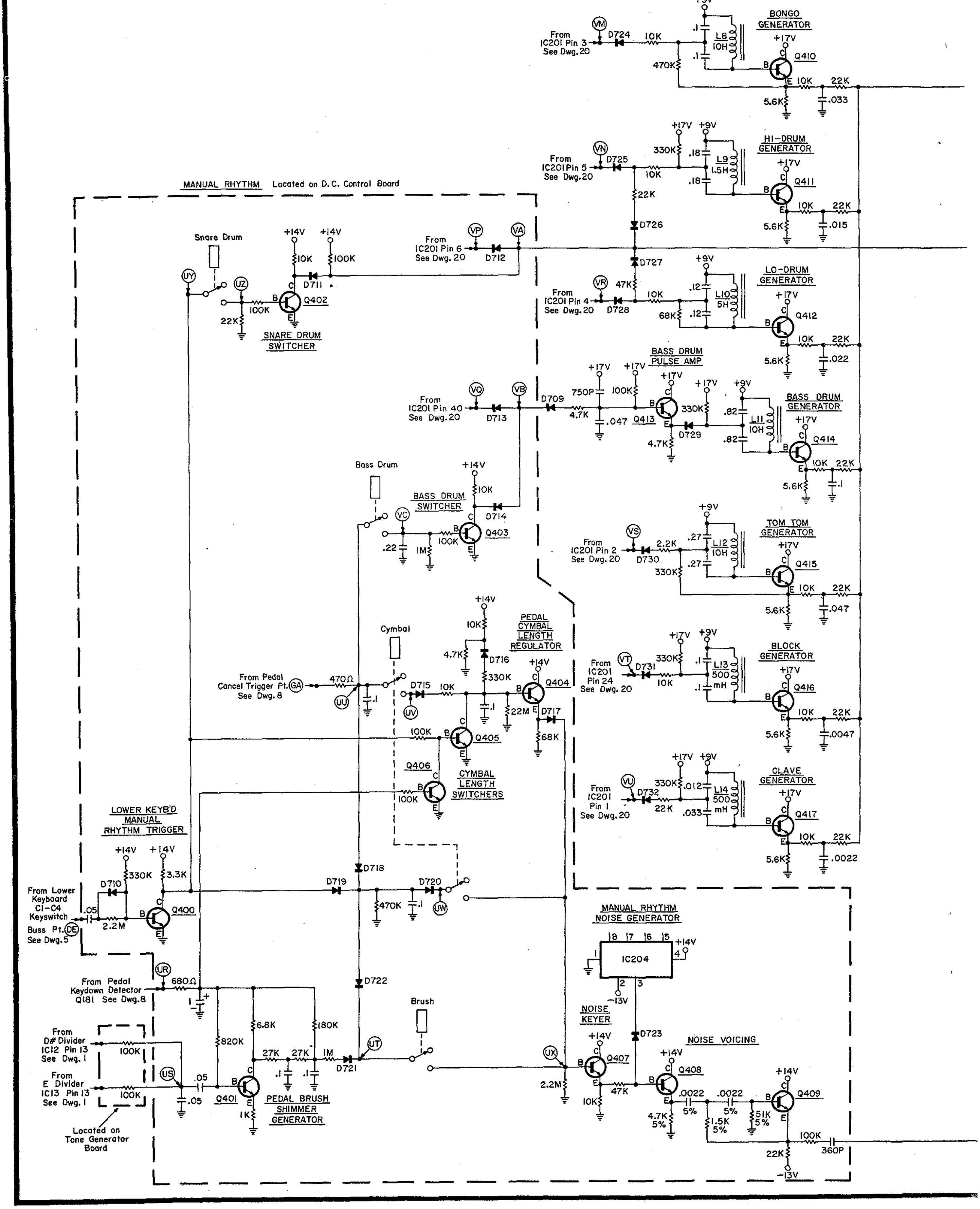
1. All resistors are 10%, 1/2 watt or less unless otherwise specified.
2. All capacitors are in microfarads unless otherwise specified.
3. All voltages measured to ground with a Simpson 260 VOM.
4. See Parts List for component part numbers.
5. All Keyswitches, Tabswitches and Pushbutton Switches shown in "off" position.
6. ✚ Denotes factory tailored component.
7. One of the best ways to persuade others is with your ears—by listening to them.
8. All Components located on Rhythm Clock Board. unless otherwise specified.
9. Circled Letter Number Designation refer to points which are called out on Phantom views.
10. As long as you belittle — you willbe little.

RHYTHM CLOCK

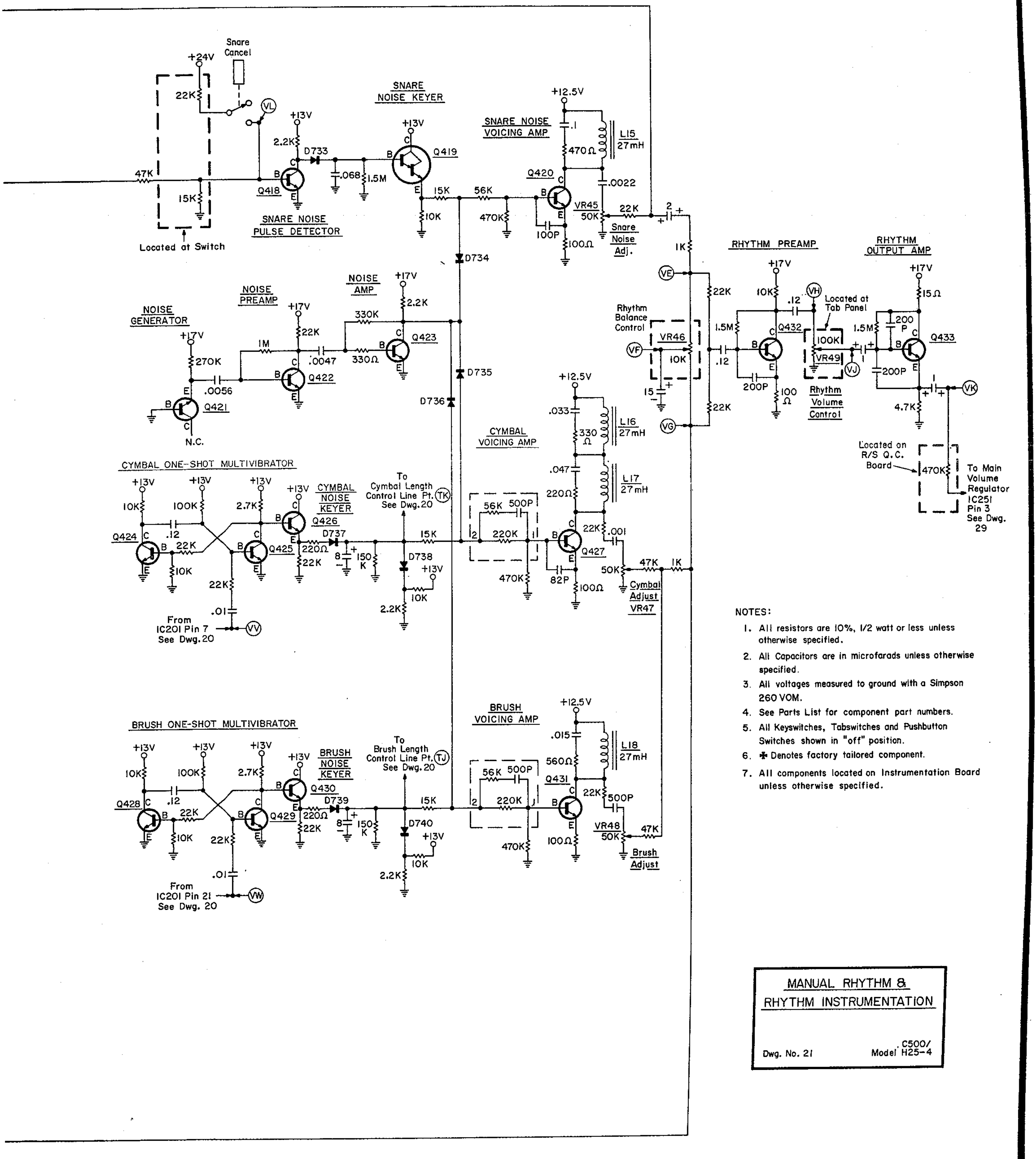
Dwg. 20

C500/
Model H25-4

SCHEMATIC 21


BONGO GENERATOR
From IC201 Pin 3 See Dwg.20
VM
D724
10K
470K
+9V
.1
L8 10H
+17V
Q410
10K
22K
5.6K
.033
HI-DRUM GENERATOR
From IC201 Pin 5 See Dwg.20
VN
D725
330K
.18
L9 1.5H
Q411
.015
22K
D726
MANUAL RHYTHM Located on D.C. Control Board
Snare Drum
UY
UZ
+14V
10K
100K
D711
Q402
22K
SNARE DRUM SWITCHER
From IC201 Pin 6 See Dwg. 20
VP
VA
D712
D727
LO-DRUM GENERATOR
From IC201 Pin 4 See Dwg.20
VR
47K
D728
68K
.12
L10 5H
Q412
.022
BASS DRUM PULSE AMP
From IC201 Pin 40 See Dwg.20
VQ
VB
D713
D709
750P
4.7K
.047
Q413
D729
BASS DRUM GENERATOR
.82
L11 10H
Q414
.1
Bass Drum
BASS DRUM SWITCHER
D714
VC
Q403
.22
1M
TOM TOM GENERATOR
From IC201 Pin 2 See Dwg. 20
VS
2.2K
D730
.27
L12 10H
Q415
.047
Cymbal
PEDAL CYMBAL LENGTH REGULATOR
4.7K
D716
330K
Q404
From Pedal Cancel Trigger Pt. GA See Dwg. 8
470Ω
UU
D715
UV
22M
D717
68K
Q405
Q406
CYMBAL LENGTH SWITCHERS
BLOCK GENERATOR
From IC201 Pin 24 See Dwg. 20
VT
D731
L13 500 mH
Q416
.0047
CLAVE GENERATOR
From IC201 Pin 1 See Dwg.20
VU
D732
22K
.012
.033
L14 500 mH
Q417
.0022
LOWER KEYB'D MANUAL RHYTHM TRIGGER
From Lower Keyboard C1-C4 Keyswitch Buss Pt. DE See Dwg.5
D710
330K
3.3K
.05
2.2M
Q400
D718
D719
D720
470K
UW
MANUAL RHYTHM NOISE GENERATOR
IC204
-13V
UR
From Pedal Keydown Detector Q181 See Dwg.8
680Ω
D722
Brush
6.8K
180K
820K
27K
1M
UT
D721
From D# Divider IC12 Pin 13 See Dwg. 1
From E Divider IC13 Pin 13 See Dwg. 1
Located on Tone Generator Board
US
Q401
1K
PEDAL BRUSH SHIMMER GENERATOR
UX
NOISE KEYER
D723
Q407
2.2M
10K
47K
NOISE VOICING
Q408
.0022 5%
4.7K 5%
1.5K 5%
51K 5%
Q409
100K
360P
22K

SCHEMATIC 21


Snare Cancel
+24V
22K
VL
47K
15K
Located at Switch
+13V
2.2K
D733
.068
1.5M
Q418
SNARE NOISE PULSE DETECTOR
SNARE NOISE KEYER
+13V
Q419
15K
10K
56K
470K
SNARE NOISE VOICING AMP
+12.5V
.1
470Ω
L15 27mH
Q420
.0022
100P
VR45 50K
22K
Snare Noise Adj.
100Ω
2
1K
D734
NOISE GENERATOR
+17V
270K
.0056
Q421
N.C.
NOISE PREAMP
+17V
1M
22K
.0047
Q422
NOISE AMP
+17V
2.2K
330K
330Ω
Q423
D735
D736
VE
VF
VG
Rhythm Balance Control
VR46
10K
15
22K
22K
RHYTHM PREAMP
+17V
10K
.12
VH
Located at Tab Panel
1.5M
.12
Q432
200P
100 Ω
100K
VR49
VJ
1
Rhythm Volume Control
RHYTHM OUTPUT AMP
+17V
15Ω
1.5M
200 P
Q433
200P
4.7K
1
VK
Located on R/S Q.C. Board
470K
To Main Volume Regulator IC251 Pin 3 See Dwg. 29
+12.5V
.033
330 Ω
L16 27mH
CYMBAL VOICING AMP
.047
L17 27mH
220Ω
56K
500P
220K
470K
Q427
22K
.001
82P
100Ω
50K
47K
1K
Cymbal Adjust VR47
CYMBAL ONE-SHOT MULTIVIBRATOR
+13V
+13V
+13V
10K
100K
2.7K
Q424
.12
22K
10K
Q425
22K
.01
From IC201 Pin 7 See Dwg.20
VV
+13V
CYMBAL NOISE KEYER
Q426
D737
220Ω
22K
8
150 K
To Cymbal Length Control Line Pt. TK See Dwg.20
D738
+13V
10K
2.2K
15K
BRUSH VOICING AMP
+12.5V
.015
L18 27mH
560Ω
Q431
22K
500P
56K
500P
220K
470K
100Ω
VR48 50K
47K
Brush Adjust
BRUSH ONE-SHOT MULTIVIBRATOR
+13V
+13V
+13V
10K
100K
2.7K
Q428
.12
22K
10K
22K
Q429
.01
From IC201 Pin 21 See Dwg. 20
VW
+13V
BRUSH NOISE KEYER
Q430
D739
220Ω
22K
8
150 K
To Brush Length Control Line Pt. TJ See Dwg.20
D740
+13V
10K
2.2K
15K

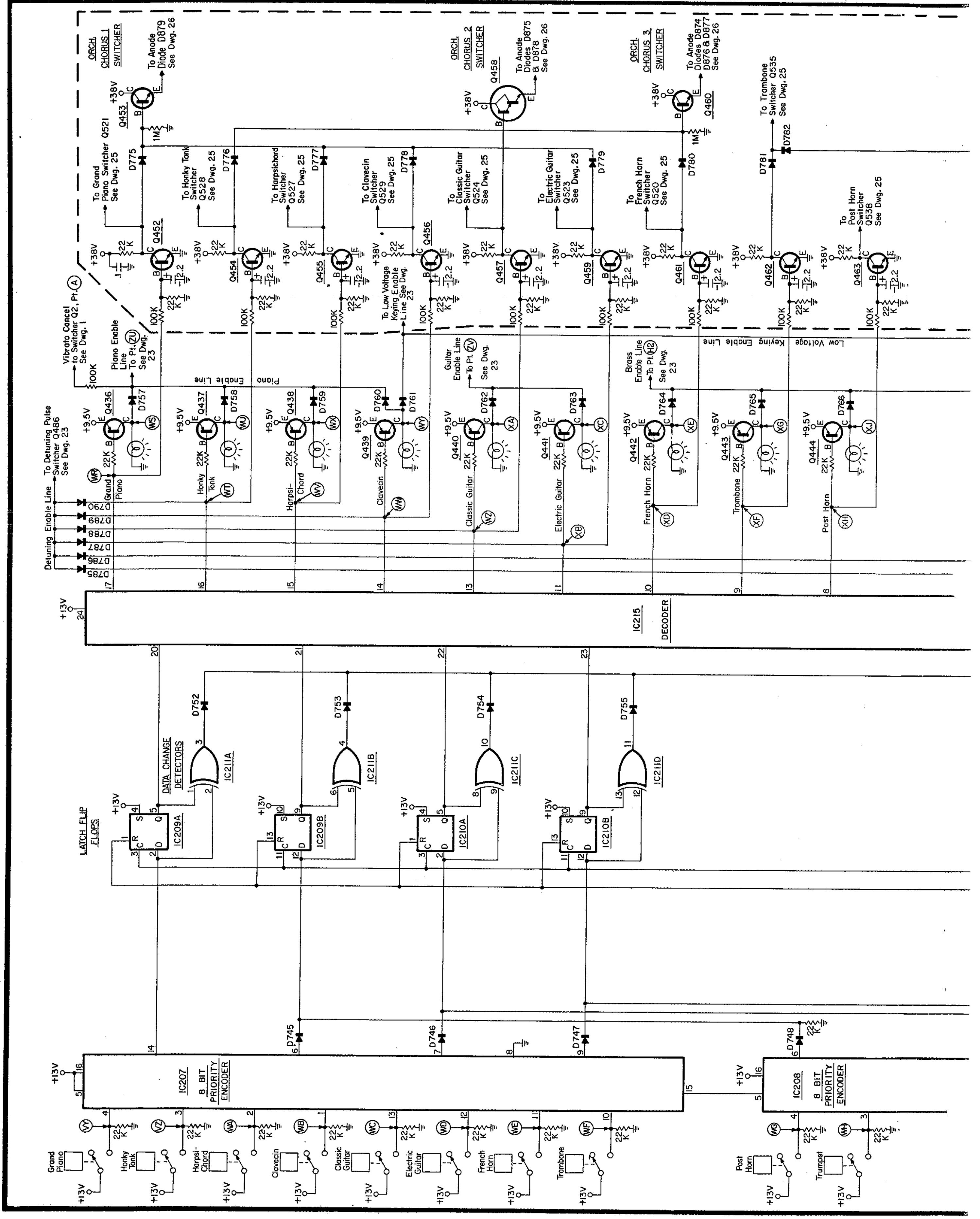
NOTES:

1. All resistors are 10%, 1/2 watt or less unless otherwise specified.
2. All Capacitors are in microfarads unless otherwise specified.
3. All voltages measured to ground with a Simpson 260 VOM.
4. See Parts List for component part numbers.
5. All Keyswitches, Tabswitches and Pushbutton Switches shown in "off" position.
6. ✱ Denotes factory tailored component.
7. All components located on Instrumentation Board unless otherwise specified.

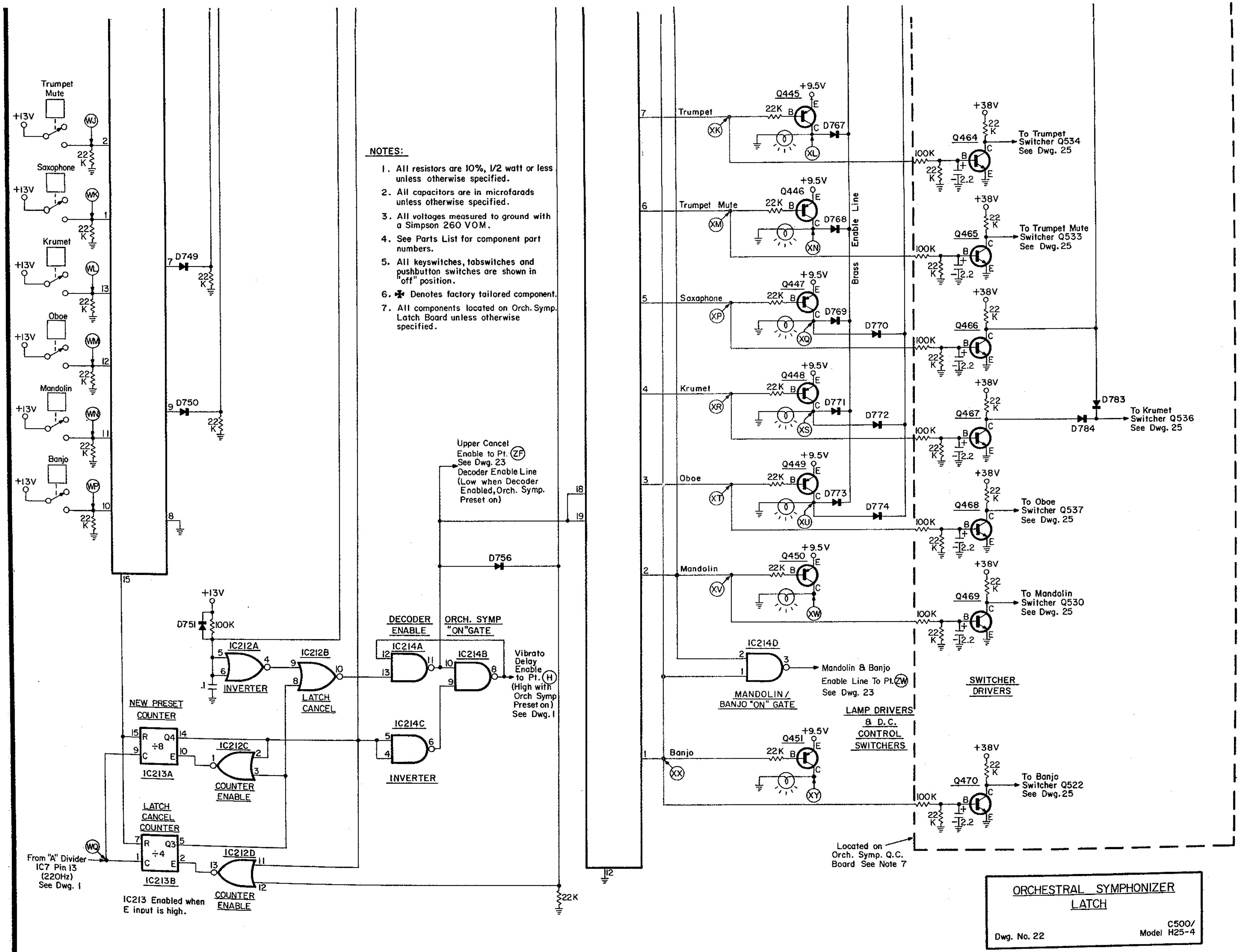
MANUAL RHYTHM &
RHYTHM INSTRUMENTATION

Dwg. No. 21
Model C500/H25-4

SCHEMATIC 22


ORCH. CHORUS 1 SWITCHER
To Anode Diode D879 See Dwg. 26
ORCH. CHORUS 2 SWITCHER
To Anode Diodes D875 & D878 See Dwg. 26
ORCH. CHORUS 3 SWITCHER
To Anode Diodes D874 D876 & D877 See Dwg. 26
To Trombone Switcher Q535 See Dwg. 25
Q453
Q458
Q460
+38V
1M
D775
D776
D777
D778
D779
D780
D781
D782
To Grand Piano Switcher Q521 See Dwg. 25
To Honky Tonk Switcher Q528 See Dwg. 25
To Harpsichord Switcher Q527 See Dwg. 25
To Clavecin Switcher Q529 See Dwg. 25
To Classic Guitar Switcher Q524 See Dwg. 25
To Electric Guitar Switcher Q523 See Dwg. 25
To French Horn Switcher Q520 See Dwg. 25
To Post Horn Switcher Q538 See Dwg. 25
Q452
Q454
Q455
Q456
Q457
Q459
Q461
Q462
Q463
22K
2.2
100K
Vibrato Cancel to Switcher Q2, Pt. Ⓐ See Dwg. 1
Piano Enable Line To Pt. ⓏⓊ See Dwg. 23
Piano Enable Line
To Low Voltage Keying Enable Line See Dwg. 23
Guitar Enable Line To Pt. ⓏⓋ See Dwg. 23
Brass Enable Line To Pt. Ⓗ② See Dwg. 23
Low Voltage Keying Enable Line
To Detuning Pulse Switcher Q486 See Dwg. 23
+9.5V
Q436
Q437
Q438
Q439
Q440
Q441
Q442
Q443
Q444
D757
D758
D759
D760
D761
D762
D763
D764
D765
D766
WS
WU
WX
WY
XA
XC
XE
XG
XJ
WR
WT
WV
WW
WZ
XB
XD
XF
XH
Grand Piano
Honky Tonk
Harpsi-Chord
Clavecin
Classic Guitar
Electric Guitar
French Horn
Trombone
Post Horn
Detuning Enable Line
D790
D789
D788
D787
D786
D785
+13V
IC215
DECODER
DATA CHANGE DETECTORS
D752
D753
D754
D755
IC211A
IC211B
IC211C
IC211D
LATCH FLIP FLOPS
IC209A
IC209B
IC210A
IC210B
D745
D746
D747
D748
IC207
8 BIT PRIORITY ENCODER
IC208
8 BIT PRIORITY ENCODER
VY
VZ
WA
WB
WC
WD
WE
WF
WG
WH
Grand Piano
Honky Tonk
Harpsi-Chord
Clavecin
Classic Guitar
Electric Guitar
French Horn
Trombone
Post Horn
Trumpet

SCHEMATIC 22


Trumpet Mute
Saxophone
Krumet
Oboe
Mandolin
Banjo
+13V
WJ
WK
WL
WM
WN
WP
WQ
22K
D749
D750
D751
D756
100K
From "A" Divider IC7 Pin 13 (220Hz) See Dwg. 1
NEW PRESET COUNTER
IC213A
LATCH CANCEL COUNTER
IC213B
IC213 Enabled when E input is high.
IC212A
INVERTER
IC212B
LATCH CANCEL
IC212C
COUNTER ENABLE
IC212D
COUNTER ENABLE
DECODER ENABLE
IC214A
ORCH. SYMP "ON"GATE
IC214B
IC214C
INVERTER
Vibrato Delay Enable to Pt. H (High with Orch Symp Preset on) See Dwg. 1
Upper Cancel Enable to Pt. ZF See Dwg. 23 Decoder Enable Line (Low when Decoder Enabled, Orch. Symp. Preset on)
IC214D
MANDOLIN / BANJO "ON" GATE
Mandolin & Banjo Enable Line To Pt. ZW See Dwg. 23
LAMP DRIVERS & D.C. CONTROL SWITCHERS
SWITCHER DRIVERS
Trumpet
Trumpet Mute
Saxophone
Krumet
Oboe
Mandolin
Banjo
XK
XL
XM
XN
XP
XQ
XR
XS
XT
XU
XV
XW
XX
XY
Q445
Q446
Q447
Q448
Q449
Q450
Q451
+9.5V
D767
D768
D769
D770
D771
D772
D773
D774
Brass Enable Line
Q464
Q465
Q466
Q467
Q468
Q469
Q470
+38V
2.2
To Trumpet Switcher Q534 See Dwg. 25
To Trumpet Mute Switcher Q533 See Dwg. 25
To Krumet Switcher Q536 See Dwg. 25
D783
D784
To Oboe Switcher Q537 See Dwg. 25
To Mandolin Switcher Q530 See Dwg. 25
To Banjo Switcher Q522 See Dwg. 25
Located on Orch. Symp. Q.C. Board See Note 7

NOTES:

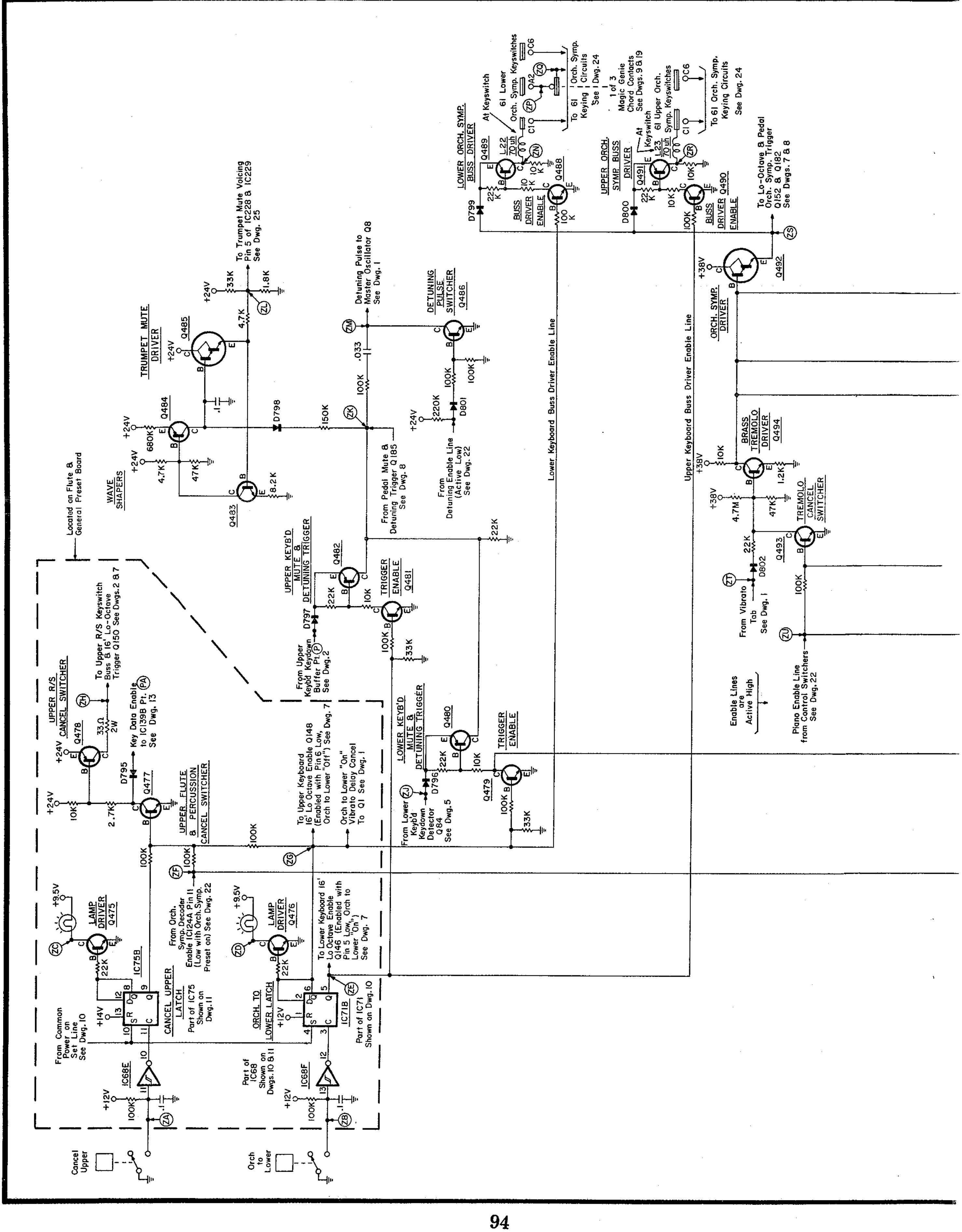
1. All resistors are 10%, 1/2 watt or less unless otherwise specified.
2. All capacitors are in microfarads unless otherwise specified.
3. All voltages measured to ground with a Simpson 260 VOM.
4. See Parts List for component part numbers.
5. All keyswitches, tabswitches and pushbutton switches are shown in "off" position.
6. ✠ Denotes factory tailored component.
7. All components located on Orch. Symp. Latch Board unless otherwise specified.

ORCHESTRAL SYMPHONIZER
LATCH

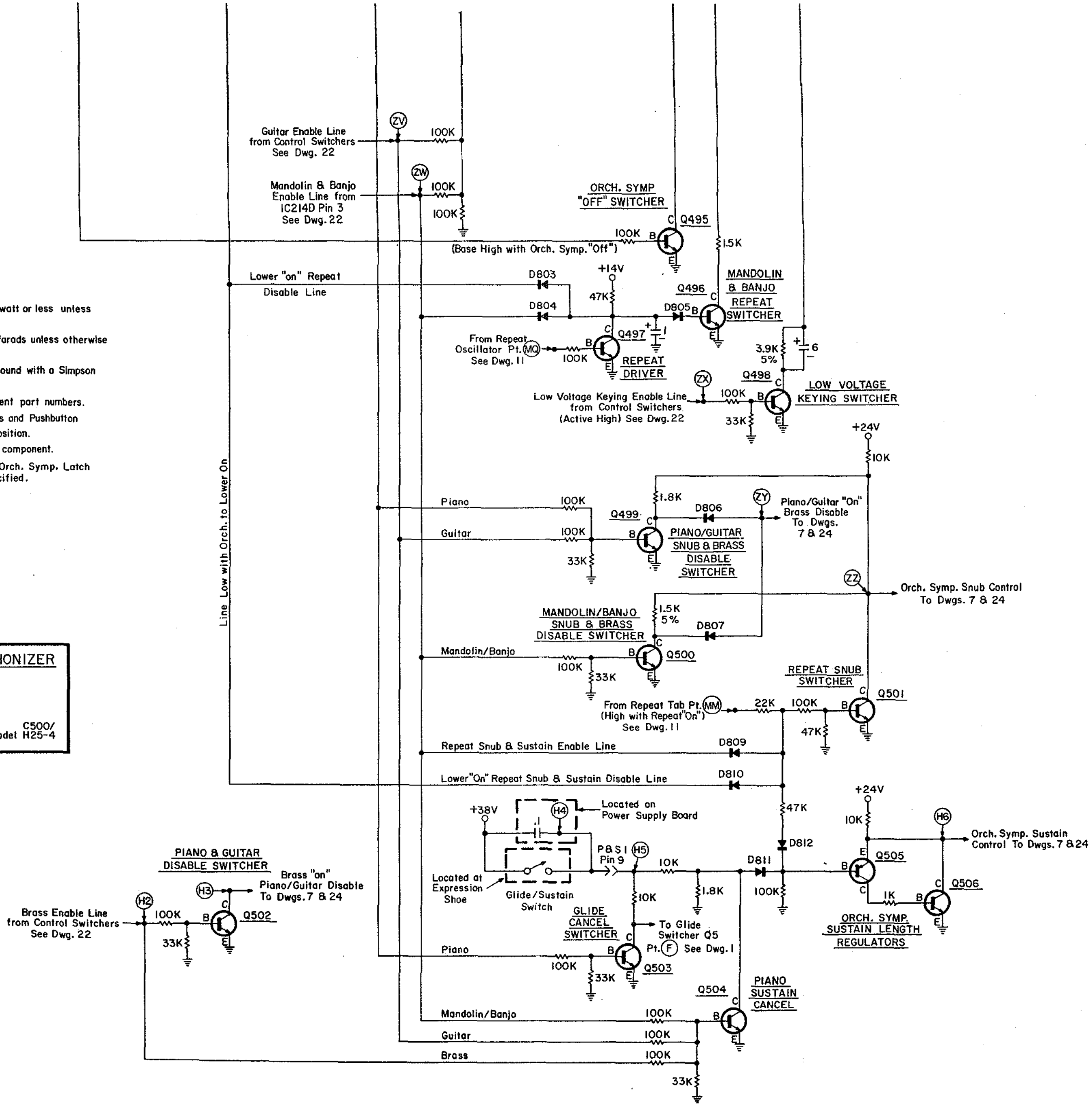
Dwg. No. 22

C500/
Model H25-4

SCHEMATIC 23


TRUMPET MUTE DRIVER
Q485
Q484
WAVE SHAPERS
Q483
To Trumpet Mute Voicing Pin 5 of IC228 & IC229 See Dwg. 25
Detuning Pulse to Master Oscillator Q8 See Dwg. 1
DETUNING PULSE SWITCHER
Q486
From Detuning Enable Line (Active Low) See Dwg. 22
From Pedal Mute & Detuning Trigger Q185 See Dwg. 8
UPPER KEYB'D MUTE & DETUNING TRIGGER
Q482
TRIGGER ENABLE
Q481
From Upper Keyb'd Keydown Buffer Pt. (F) See Dwg. 2
LOWER KEYB'D MUTE & DETUNING TRIGGER
Q480
TRIGGER ENABLE
Q479
From Lower Keyb'd Keydown Detector Q84 See Dwg. 5
Lower Keyboard Buss Driver Enable Line
Upper Keyboard Buss Driver Enable Line
LOWER ORCH. SYMP. BUSS DRIVER
Q489
BUSS DRIVER ENABLE
Q488
At Keyswitch
61 Lower Orch. Symp. Keyswitches
To 61 Orch. Symp. Keying Circuits See Dwg. 24
1 of 3 Magic Genie Chord Contacts See Dwgs. 9 & 19
UPPER ORCH. SYMP. BUSS DRIVER
Q491
BUSS DRIVER ENABLE
Q490
At Keyswitch
61 Upper Orch. Symp. Keyswitches
To 61 Orch. Symp. Keying Circuits See Dwg. 24
To Lo-Octave & Pedal Orch. Symp. Trigger Q152 & Q182 See Dwgs. 7 & 8
ORCH. SYMP. DRIVER
Q492
BRASS TREMOLO DRIVER
Q494
TREMOLO CANCEL SWITCHER
Q493
From Vibrato Tab See Dwg. 1
Enable Lines are Active High
Piano Enable Line from Control Switchers See Dwg. 22
Located on Flute & General Preset Board
UPPER R/S CANCEL SWITCHER
Q478
To Upper R/S Keyswitch Buss & 16' Lo-Octave Trigger Q150 See Dwgs. 2 & 7
Key Data Enable to IC139B Pt. (PA) See Dwg. 13
UPPER FLUTE & PERCUSSION CANCEL SWITCHER
Q477
To Upper Keyboard 16' Lo Octave Enable Q148 (Enabled with Pin 6 Low, Orch to Lower "Off") See Dwg. 7
Orch to Lower "On" Vibrato Delay Cancel To Q1 See Dwg. 1
From Orch. Symp. Decoder Enable IC124A Pin 11 (Low with Orch. Symp. Preset on) See Dwg. 22
LAMP DRIVER
Q475
LAMP DRIVER
Q476
To Lower Keyboard 16' Lo Octave Enable Q146 (Enabled with Pin 5 Low, Orch to Lower "On") See Dwg. 7
IC75B
CANCEL UPPER LATCH
Part of IC75 Shown on Dwg. 11
ORCH. TO LOWER LATCH
IC71B
Part of IC71 Shown on Dwg. 10
From Common Power on Set Line See Dwg. 10
IC68E
IC68F
Part of IC68 Shown on Dwgs. 10 & 11
Cancel Upper
Orch to Lower
ZA
ZB
ZC
ZD
ZE
ZF
ZG
ZH
ZJ
ZK
ZL
ZM
ZN
ZP
ZQ
ZR
ZS
ZT
ZU
D795
D796
D797
D798
D799
D800
D801
D802
L22 70uh
L23 70uh
+24V
+38V
+12V
+14V
+9.5V

SCHEMATIC 23


Guitar Enable Line from Control Switchers See Dwg. 22
ZV
100K
Mandolin & Banjo Enable Line from IC214D Pin 3 See Dwg. 22
ZW
100K
100K
ORCH. SYMP "OFF" SWITCHER
Q495
100K
(Base High with Orch. Symp."Off")
1.5K
Lower "on" Repeat Disable Line
D803
D804
+14V
47K
Q496
D805
MANDOLIN & BANJO REPEAT SWITCHER
Q497
1
From Repeat Oscillator Pt. MQ See Dwg. 11
100K
REPEAT DRIVER
3.9K 5%
6
Q498
ZX
Low Voltage Keying Enable Line from Control Switchers (Active High) See Dwg. 22
100K
33K
LOW VOLTAGE KEYING SWITCHER
+24V
10K
Line Low with Orch. to Lower On
Piano
Guitar
100K
100K
33K
Q499
1.8K
D806
ZY
Piano/Guitar "On" Brass Disable To Dwgs. 7 & 24
PIANO/GUITAR SNUB & BRASS DISABLE SWITCHER
ZZ
Orch. Symp. Snub Control To Dwgs. 7 & 24
MANDOLIN/BANJO SNUB & BRASS DISABLE SWITCHER
1.5K 5%
D807
Mandolin/Banjo
100K
33K
Q500
REPEAT SNUB SWITCHER
From Repeat Tab Pt. MM (High with Repeat "On") See Dwg. 11
22K
100K
47K
Q501
Repeat Snub & Sustain Enable Line
D809
Lower "On" Repeat Snub & Sustain Disable Line
D810
+38V
H4
Located on Power Supply Board
47K
D812
+24V
10K
H6
Orch. Symp. Sustain Control To Dwgs. 7 & 24
PIANO & GUITAR DISABLE SWITCHER
H3
Brass "on" Piano/Guitar Disable To Dwgs. 7 & 24
H2
Brass Enable Line from Control Switchers See Dwg. 22
100K
33K
Q502
Located at Expression Shoe
Glide/Sustain Switch
P&S1 Pin 9
H5
10K
1.8K
D811
100K
Q505
1K
Q506
ORCH. SYMP. SUSTAIN LENGTH REGULATORS
10K
GLIDE CANCEL SWITCHER
To Glide Switcher Q5 Pt. F See Dwg. 1
Piano
100K
33K
Q503
Q504
PIANO SUSTAIN CANCEL
Mandolin/Banjo
Guitar
Brass
100K
100K
100K
33K

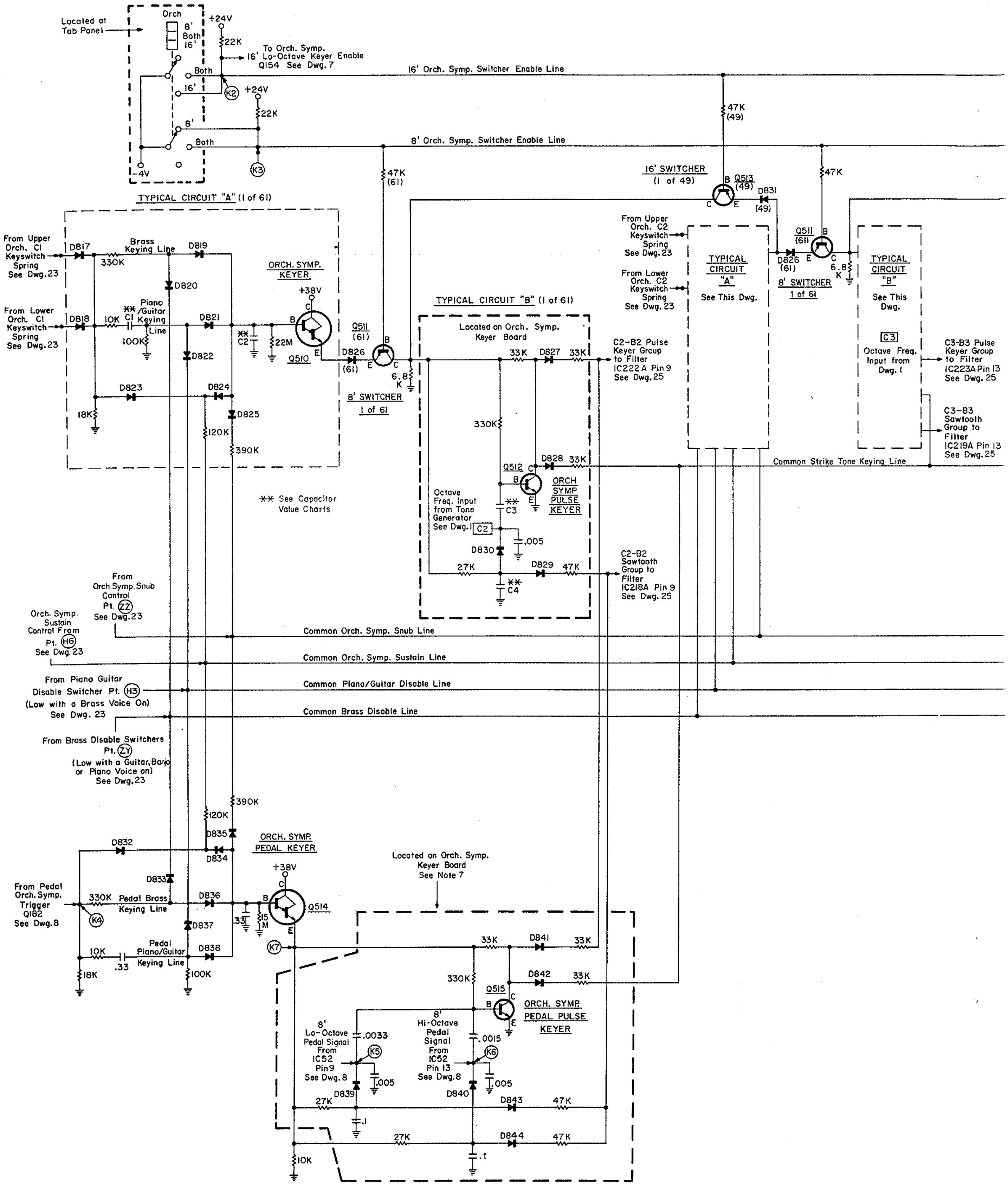
NOTES:

1. All resistors are 10%, 1/2 watt or less unless otherwise specified.
2. All Capacitors are in microfarads unless otherwise specified.
3. All voltages measured to ground with a Simpson 260 VOM.
4. See Parts List for component part numbers.
5. All Keyswitches, Tabswitches and Pushbutton Switches shown in "off" position.
6. ✤ Denotes factory tailored component.
7. All components located on Orch. Symp. Latch Board unless otherwise specified.

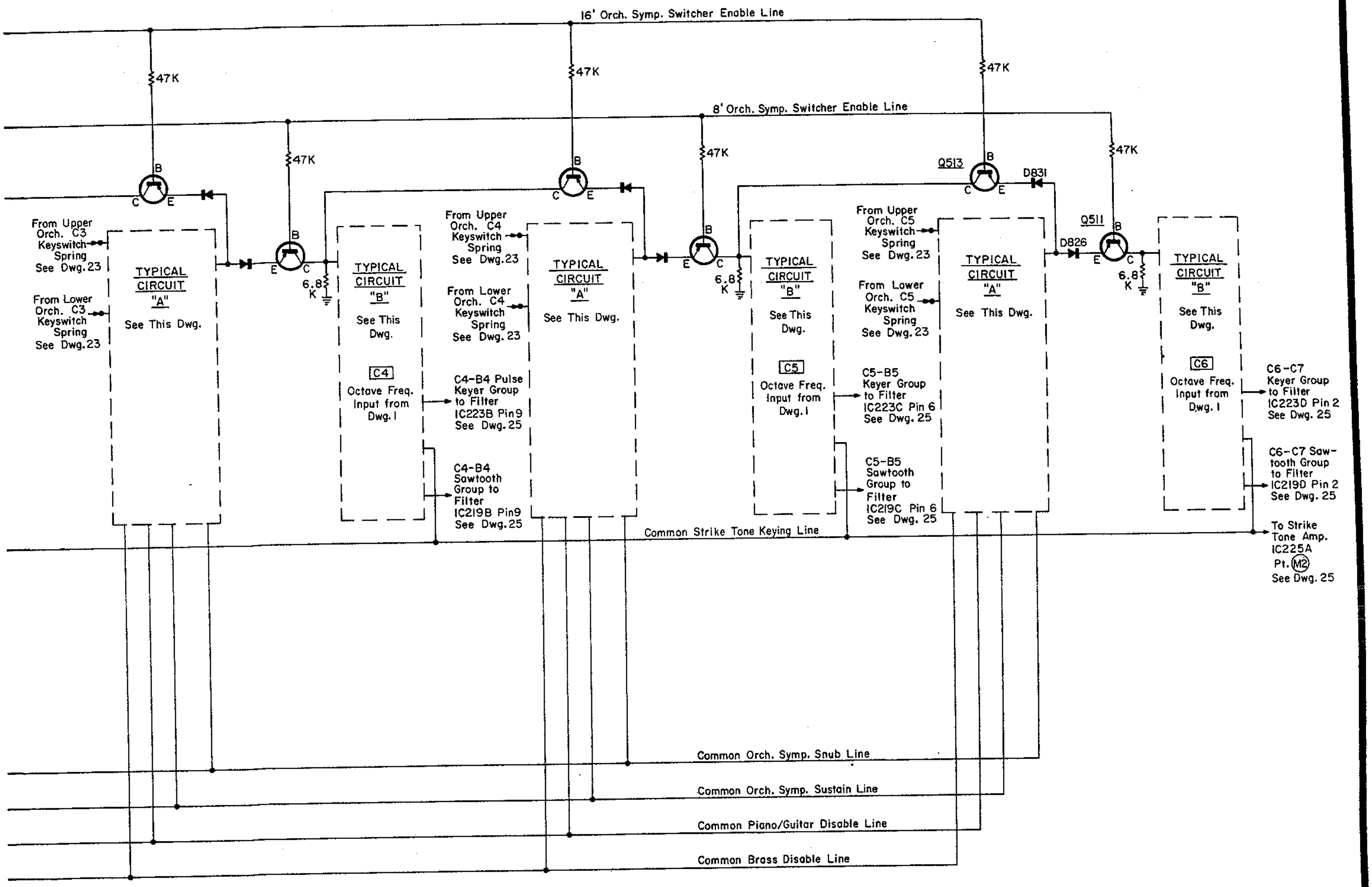
ORCHESTRAL SYMPHONIZER
CONTROL

Dwg. No. 23
C500/
Model H25-4

SCHEMATIC 24


Located at Tab Panel
Orch
8'
Both
16'
+24V
22K
To Orch. Symp. 16' Lo-Octave Keyer Enable Q154 See Dwg. 7
Both
16'
K2
+24V
22K
8'
Both
-4V
K3
16' Orch. Symp. Switcher Enable Line
8' Orch. Symp. Switcher Enable Line
47K (49)
47K (61)
47K
TYPICAL CIRCUIT "A" (1 of 61)
From Upper Orch. C1 Keyswitch Spring See Dwg. 23
D817
Brass Keying Line
330K
D819
D820
From Lower Orch. C1 Keyswitch Spring See Dwg. 23
D818
10K
C1
Piano /Guitar Keying Line
100K
D821
D822
D823
D824
D825
18K
120K
390K
ORCH. SYMP. KEYER
+38V
C2
22M
Q510
Q511 (61)
D826 (61)
8' SWITCHER 1 of 61
6.8 K
** See Capacitor Value Charts
16' SWITCHER (1 of 49)
Q513 (49)
D831 (49)
From Upper Orch. C2 Keyswitch Spring See Dwg. 23
From Lower Orch. C2 Keyswitch Spring See Dwg. 23
TYPICAL CIRCUIT "A" See This Dwg.
Q511 (61)
D826 (61)
8' SWITCHER 1 of 61
6.8 K
TYPICAL CIRCUIT "B" See This Dwg.
C3
Octave Freq. Input from Dwg. 1
C3-B3 Pulse Keyer Group to Filter IC223A Pin 13 See Dwg. 25
C3-B3 Sawtooth Group to Filter IC219A Pin 13 See Dwg. 25
TYPICAL CIRCUIT "B" (1 of 61)
Located on Orch. Symp. Keyer Board
33K
D827
33K
C2-B2 Pulse Keyer Group to Filter IC222A Pin 9 See Dwg. 25
330K
D828
33K
Q512
ORCH SYMP PULSE KEYER
Octave Freq. Input from Tone Generator See Dwg. 1 C2
C3
.005
D830
27K
D829
47K
C4
C2-B2 Sawtooth Group to Filter IC218A Pin 9 See Dwg. 25
Common Strike Tone Keying Line
From Orch Symp. Snub Control Pt. ZZ See Dwg. 23
Orch. Symp. Sustain Control From Pt. H6 See Dwg. 23
Common Orch. Symp. Snub Line
Common Orch. Symp. Sustain Line
From Piano Guitar Disable Switcher Pt. H3 (Low with a Brass Voice On) See Dwg. 23
Common Piano/Guitar Disable Line
Common Brass Disable Line
From Brass Disable Switchers Pt. ZY (Low with a Guitar, Banjo or Piano Voice on) See Dwg. 23
390K
120K
D835
D834
D832
D833
ORCH. SYMP. PEDAL KEYER
+38V
From Pedal Orch. Symp. Trigger Q182 See Dwg. 8
330K
Pedal Brass Keying Line
K4
D836
D837
Q514
.33
15 M
10K
.33
Pedal Piano/Guitar Keying Line
D838
18K
100K
K7
Located on Orch. Symp. Keyer Board See Note 7
33K
D841
33K
330K
D842
33K
Q515
ORCH. SYMP. PEDAL PULSE KEYER
8' Lo-Octave Pedal Signal From IC52 Pin 9 See Dwg. 8
.0033
K5
.005
D839
27K
.1
8' Hi-Octave Pedal Signal From IC52 Pin 13 See Dwg. 8
.0015
K6
.005
D840
D843
47K
27K
D844
47K
.1
10K

SCHEMATIC 24


16' Orch. Symp. Switcher Enable Line
8' Orch. Symp. Switcher Enable Line
47K
47K
47K
47K
47K
47K
B
C
E
6.8 K
Q513
D831
Q511
D826
From Upper Orch. C3 Keyswitch Spring See Dwg.23
From Lower Orch. C3 Keyswitch Spring See Dwg.23
TYPICAL CIRCUIT "A" See This Dwg.
TYPICAL CIRCUIT "B" See This Dwg.
C4
Octave Freq. Input from Dwg. I
From Upper Orch. C4 Keyswitch Spring See Dwg.23
From Lower Orch. C4 Keyswitch Spring See Dwg. 23
C4-B4 Pulse Keyer Group to Filter IC223B Pin9 See Dwg. 25
C4-B4 Sawtooth Group to Filter IC219B Pin9 See Dwg.25
TYPICAL CIRCUIT "A" See This Dwg.
TYPICAL CIRCUIT "B" See This Dwg.
C5
Octave Freq. Input from Dwg. I
From Upper Orch. C5 Keyswitch Spring See Dwg. 23
From Lower Orch. C5 Keyswitch Spring See Dwg. 23
C5-B5 Keyer Group to Filter IC223C Pin 6 See Dwg. 25
C5-B5 Sawtooth Group to Filter IC219C Pin 6 See Dwg. 25
TYPICAL CIRCUIT "A" See This Dwg.
TYPICAL CIRCUIT "B" See This Dwg.
C6
Octave Freq. Input from Dwg. I
C6-C7 Keyer Group to Filter IC223D Pin 2 See Dwg. 25
C6-C7 Saw-tooth Group to Filter IC219D Pin 2 See Dwg. 25
Common Strike Tone Keying Line
To Strike Tone Amp. IC225A Pt. M2 See Dwg. 25
Common Orch. Symp. Snub Line
Common Orch. Symp. Sustain Line
Common Piano/Guitar Disable Line
Common Brass Disable Line

NOTES:

1. All resistors are 10%, 1/2 watt or less unless otherwise specified.
2. All Capacitors are in microfarads unless otherwise specified.
3. All voltages measured to ground with a Simpson 260 VOM.
4. See Parts List for component part numbers.
5. All Keyswitches, Tabswitches and Pushbutton Switches shown in "off" position.
6. ✚ Denotes factory tailored component.
7. All components located on Orch. Symp. Keying Control Boards 1 & 2 unless otherwise specified.

Keyswitch Group	C1	C2
C1-B2	.33	.33
C3-B3	.27	.27
C4-C6	.22	.22

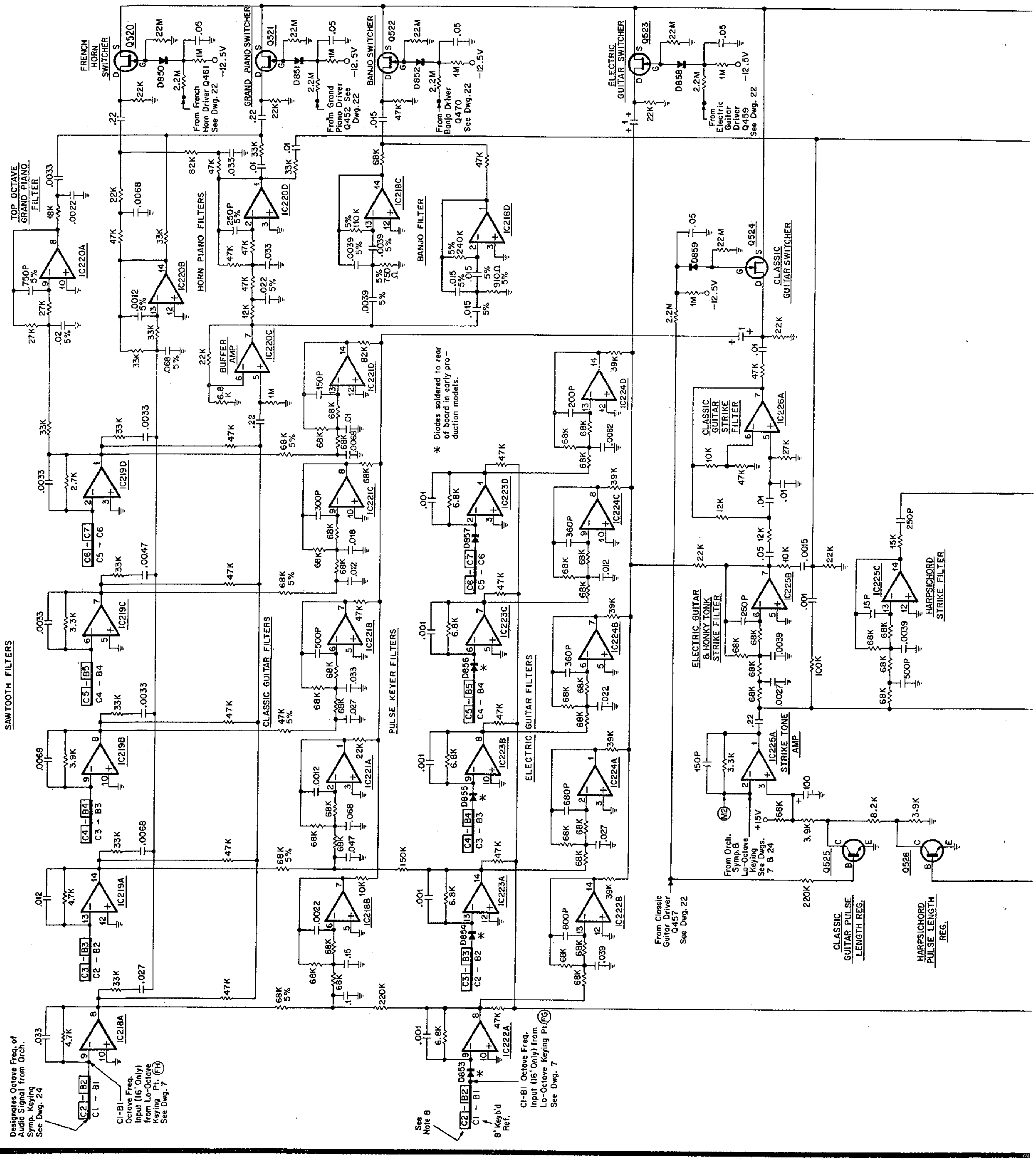
Octave Freq. Group	C3
C2-E2	.0033
F2-A#2	.0022
B2-E3	.0015
F3-A#3	.001
B3-A#4	750P
B4-A#5	500P
B5-C7	360P

Octave Freq. Group	C4
C2-F2	.1
F#2-F3	.1
F#3-F4	.05
F#4-B4	.02
C5-B5	.01
C6-C7	.005

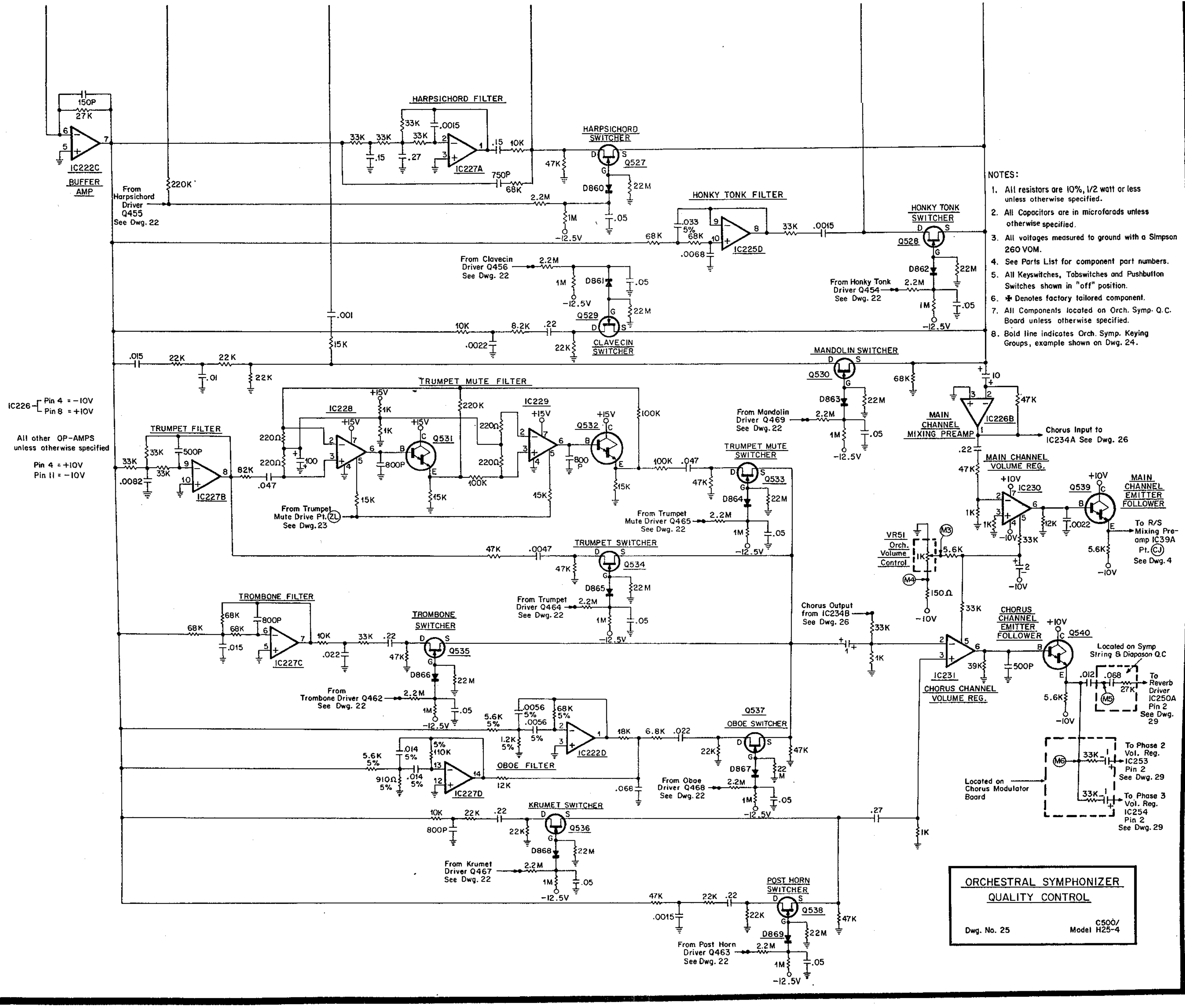
ORCHESTRAL SYMPHONIZER
KEYING

Dwg. No.24
Model C500/H25-4

SCHEMATIC 25


FRENCH HORN SWITCHER
Q520
D850
From French Horn Driver Q461 See Dwg. 22
GRAND PIANO SWITCHER
Q521
D851
From Grand Piano Driver Q452 See Dwg. 22
BANJO SWITCHER
Q522
D852
From Banjo Driver Q470 See Dwg. 22
ELECTRIC GUITAR SWITCHER
Q523
D858
From Electric Guitar Driver Q459 See Dwg. 22
-12.5V
TOP OCTAVE GRAND PIANO FILTER
IC220A
HORN PIANO FILTERS
IC220B
IC220D
BANJO FILTER
IC218C
IC218D
BUFFER AMP
IC220C
CLASSIC GUITAR SWITCHER
Q524
D859
CLASSIC GUITAR STRIKE FILTER
IC226A
SAWTOOTH FILTERS
IC219D
IC219C
IC219B
IC219A
IC218A
CLASSIC GUITAR FILTERS
IC221D
IC221C
IC221B
IC221A
IC218B
PULSE KEYER FILTERS
* Diodes soldered to rear of board in early production models.
IC223D
IC223C
IC223B
IC223A
IC222A
D853
D854
D855
D856
D857
ELECTRIC GUITAR FILTERS
IC224D
IC224C
IC224B
IC224A
IC222B
ELECTRIC GUITAR & HONKY TONK STRIKE FILTER
IC225B
HARPSICHORD STRIKE FILTER
IC225C
STRIKE TONE AMP
IC225A
+15V
M2
From Orch. Symp. B Lo-Octave Keying See Dwgs. 7 & 24
From Classic Guitar Driver Q457 See Dwg. 22
Q525
CLASSIC GUITAR PULSE LENGTH REG.
Q526
HARPSICHORD PULSE LENGTH REG.
C6 - C7
C5 - C6
C5 - B5
C4 - B4
C4 - B4
C3 - B3
C3 - B3
C2 - B2
C2 - B2
C1 - B1
Designates Octave Freq. of Audio Signal from Orch. Symp. Keying See Dwg. 24
C1-B1 Octave Freq. Input (16' Only) from Lo-Octave Keying Pt. FH See Dwg. 7
See Note 8
8' Keyb'd Ref.
C1-B1 Octave Freq. Input (16' Only) from Lo-Octave Keying Pt. FG See Dwg. 7

SCHEMATIC 25


HARPSICHORD FILTER
HARPSICHORD SWITCHER
Q527
D860
IC227A
IC222C
BUFFER AMP
From Harpsichord Driver Q455 See Dwg. 22
HONKY TONK FILTER
IC225D
HONKY TONK SWITCHER
Q528
D862
From Honky Tonk Driver Q454 See Dwg. 22
From Clavecin Driver Q456 See Dwg. 22
D861
Q529
CLAVECIN SWITCHER
MANDOLIN SWITCHER
Q530
D863
From Mandolin Driver Q469 See Dwg. 22
MAIN CHANNEL MIXING PREAMP
IC226B
Chorus Input to IC234A See Dwg. 26
MAIN CHANNEL VOLUME REG.
IC230
Q539
MAIN CHANNEL EMITTER FOLLOWER
To R/S Mixing Pre-amp IC39A Pt. CJ See Dwg. 4
VR51 Orch. Volume Control
M3
M4
TRUMPET MUTE FILTER
IC228
IC229
Q531
Q532
From Trumpet Mute Drive Pt. ZL See Dwg. 23
TRUMPET MUTE SWITCHER
Q533
D864
From Trumpet Mute Driver Q465 See Dwg. 22
TRUMPET FILTER
IC227B
TRUMPET SWITCHER
Q534
D865
From Trumpet Driver Q464 See Dwg. 22
Chorus Output from IC234B See Dwg. 26
IC231
CHORUS CHANNEL VOLUME REG.
CHORUS CHANNEL EMITTER FOLLOWER
Q540
Located on Symp String & Diapason Q.C
To Reverb Driver IC250A Pin 2 See Dwg. 29
M5
M6
To Phase 2 Vol. Reg. IC253 Pin 2 See Dwg. 29
To Phase 3 Vol. Reg. IC254 Pin 2 See Dwg. 29
Located on Chorus Modulator Board
TROMBONE FILTER
IC227C
TROMBONE SWITCHER
Q535
D866
From Trombone Driver Q462 See Dwg. 22
IC222D
OBOE FILTER
IC227D
OBOE SWITCHER
Q537
D867
From Oboe Driver Q468 See Dwg. 22
KRUMET SWITCHER
Q536
D868
From Krumet Driver Q467 See Dwg. 22
POST HORN SWITCHER
Q538
D869
From Post Horn Driver Q463 See Dwg. 22
IC226 Pin 4 = −10V Pin 8 = +10V
All other OP-AMPS unless otherwise specified
Pin 4 = +10V
Pin 11 = −10V

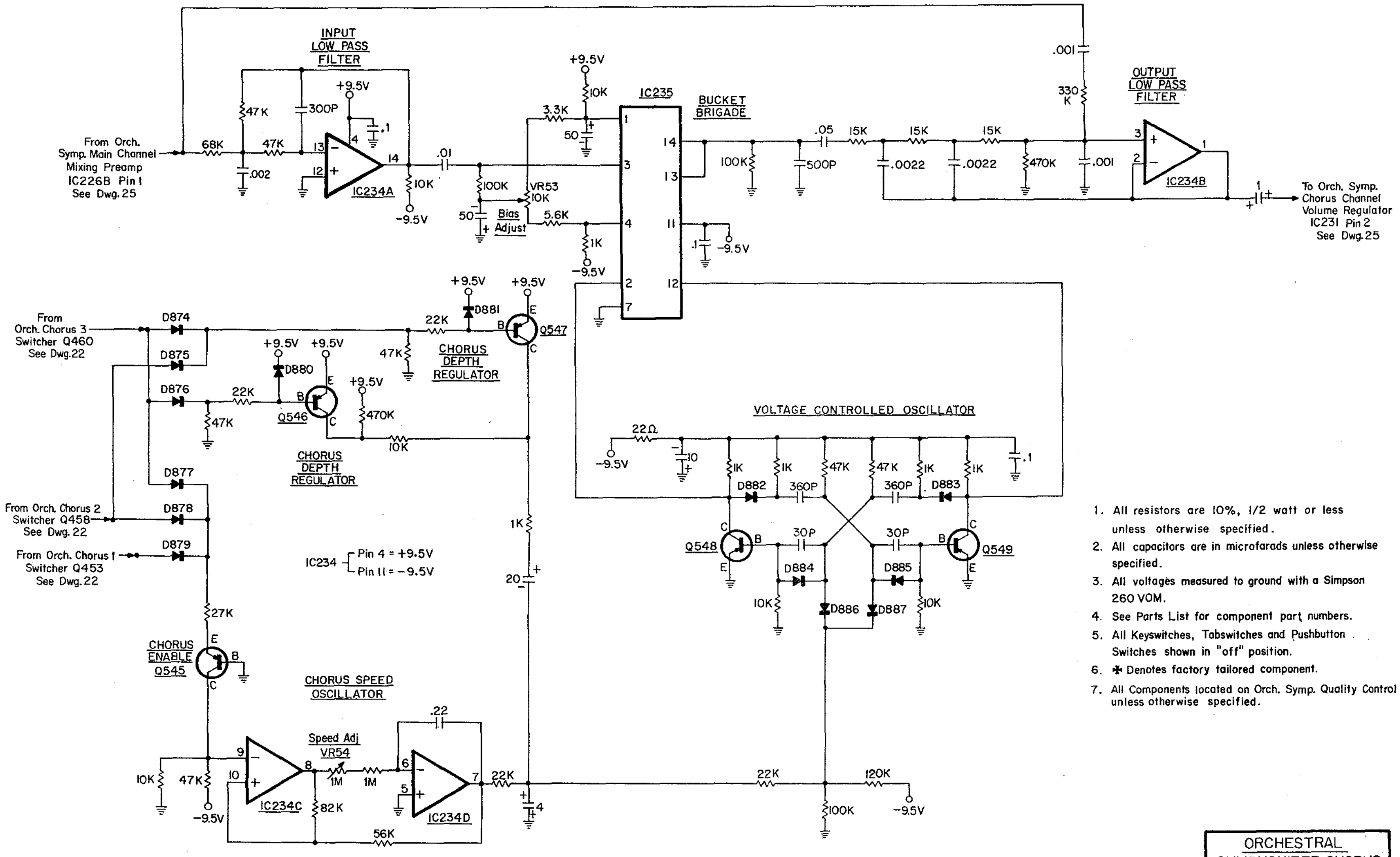
NOTES:

1. All resistors are 10%, 1/2 watt or less unless otherwise specified.
2. All Capacitors are in microfarads unless otherwise specified.
3. All voltages measured to ground with a Simpson 260 VOM.
4. See Parts List for component part numbers.
5. All Keyswitches, Tabswitches and Pushbutton Switches shown in "off" position.
6. ✱ Denotes factory tailored component.
7. All Components located on Orch. Symp. Q.C. Board unless otherwise specified.
8. Bold line indicates Orch. Symp. Keying Groups, example shown on Dwg. 24.

ORCHESTRAL SYMPHONIZER
QUALITY CONTROL

Dwg. No. 25
C500/
Model H25-4

SCHEMATIC 26


INPUT LOW PASS FILTER
From Orch. Symp. Main Channel Mixing Preamp IC226B Pin 1 See Dwg. 25
68K
47K
47K
300P
.002
+9.5V
.1
IC234A
10K
-9.5V
.01
100K
50
VR53 10K
Bias Adjust
3.3K
10K
50
5.6K
1K
-9.5V
IC235
BUCKET BRIGADE
100K
.05
500P
15K
15K
15K
.0022
.0022
470K
.001
330 K
.001
OUTPUT LOW PASS FILTER
IC234B
1
To Orch. Symp. Chorus Channel Volume Regulator IC231 Pin 2 See Dwg. 25
.1
-9.5V
From Orch. Chorus 3 Switcher Q460 See Dwg. 22
From Orch. Chorus 2 Switcher Q458 See Dwg. 22
From Orch. Chorus 1 Switcher Q453 See Dwg. 22
D874
D875
D876
D877
D878
D879
D880
D881
22K
47K
Q546
Q547
470K
10K
CHORUS DEPTH REGULATOR
CHORUS DEPTH REGULATOR
IC234 Pin 4 = +9.5V Pin 11 = -9.5V
1K
20
27K
CHORUS ENABLE Q545
CHORUS SPEED OSCILLATOR
10K
47K
IC234C
Speed Adj VR54
1M
1M
82K
56K
.22
IC234D
22K
4
VOLTAGE CONTROLLED OSCILLATOR
22Ω
10
1K
1K
47K
47K
1K
1K
D882
D883
360P
360P
30P
30P
Q548
Q549
D884
D885
D886
D887
10K
10K
22K
120K
100K
-9.5V

1. All resistors are 10%, 1/2 watt or less unless otherwise specified.
2. All capacitors are in microfarads unless otherwise specified.
3. All voltages measured to ground with a Simpson 260 VOM.
4. See Parts List for component part numbers.
5. All Keyswitches, Tabswitches and Pushbutton Switches shown in "off" position.
6. ✱ Denotes factory tailored component.
7. All Components located on Orch. Symp. Quality Control Bd. unless otherwise specified.

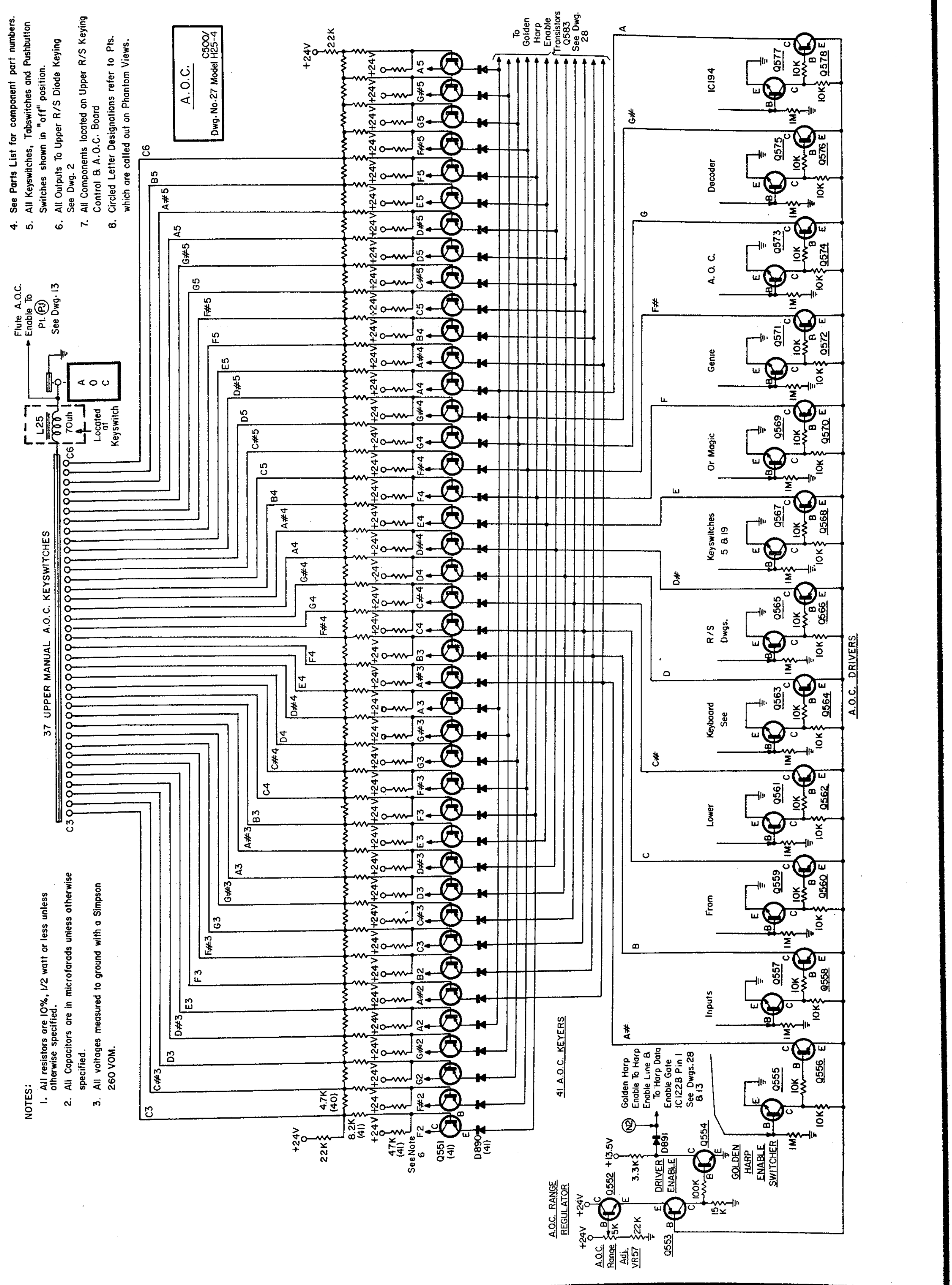
ORCHESTRAL
SYMPHONIZER CHORUS

Dwg. No. 26
C500/
Model H25-4

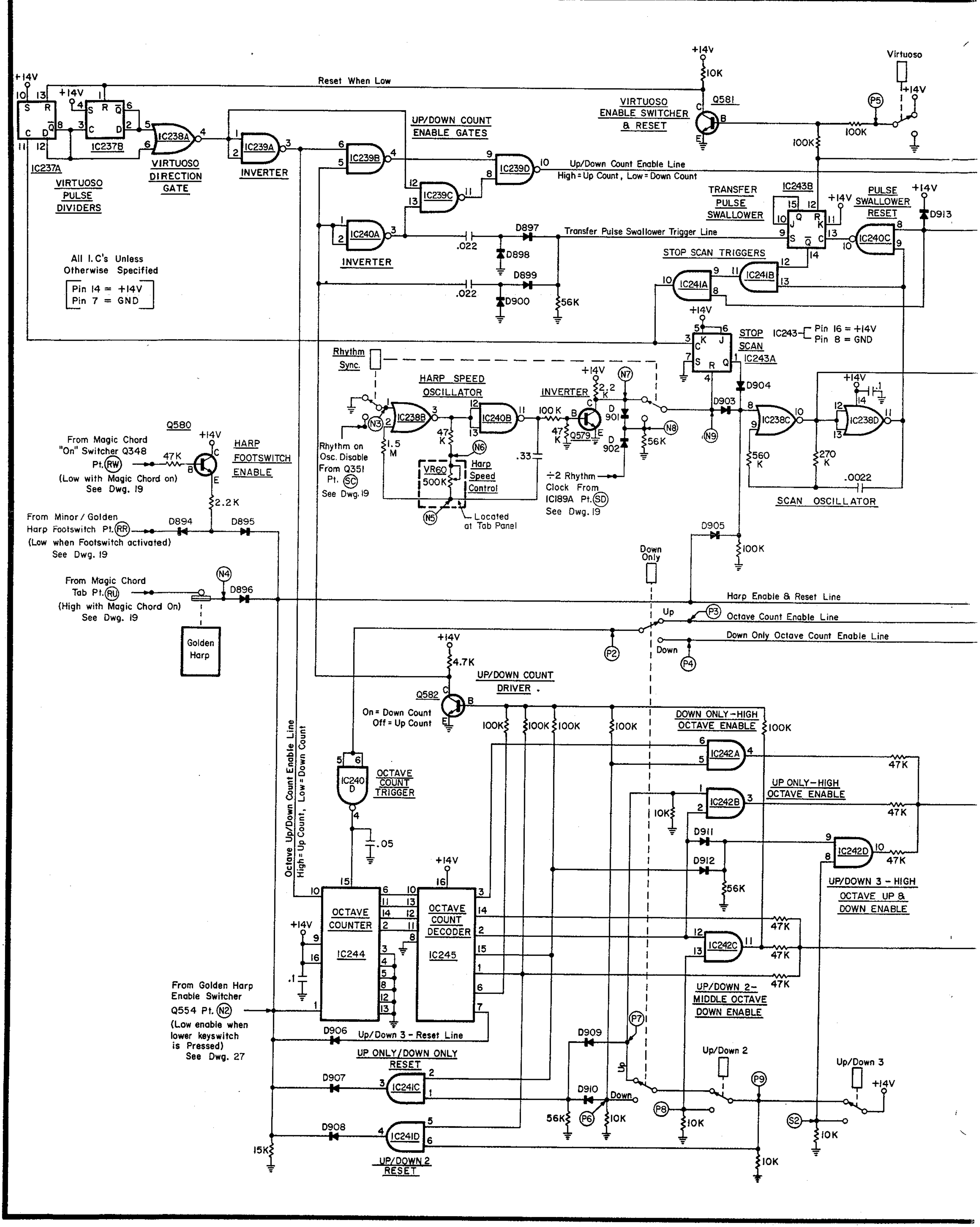
SCHEMATIC 27

NOTES:

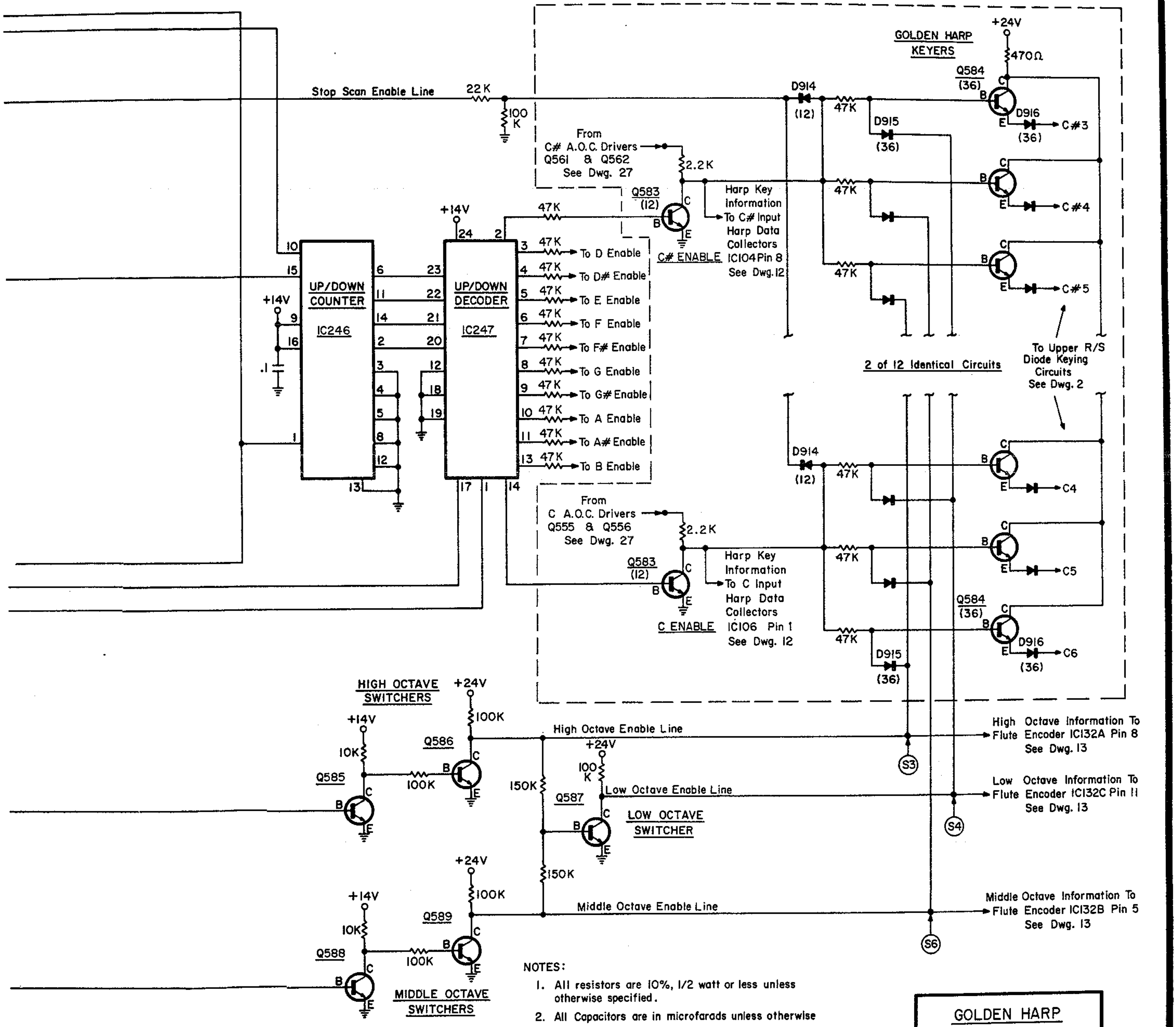
1. All resistors are 10%, 1/2 watt or less unless otherwise specified.
2. All Capacitors are in microfarads unless otherwise specified.
3. All voltages measured to ground with a Simpson 260 VOM.
4. See Parts List for component part numbers.
5. All Keyswitches, Tabswitches and Pushbutton Switches shown in "off" position.
6. All Outputs To Upper R/S Diode Keying See Dwg. 2
7. All Components located on Upper R/S Keying Control & A.O.C. Board
8. Circled Letter Designations refer to Pts. which are called out on Phantom Views.


A.O.C.
C500/
Dwg.No.27 Model H25-4
37 UPPER MANUAL A.O.C. KEYSWITCHES
41 A.O.C. KEYERS
A.O.C. DRIVERS
Flute A.O.C. Enable To Pt. (R) See Dwg. 13
L25
70uh
Located at Keyswitch
A O C
To Golden Harp Enable Transistors Q583 See Dwg. 28
+24V
22K
4.7K (40)
8.2K (41)
47K (41)
See Note 6
Q551 (41)
D890 (41)
C3
C#3
D3
D#3
E3
F3
F#3
G3
G#3
A3
A#3
B3
C4
C#4
D4
D#4
E4
F4
F#4
G4
G#4
A4
A#4
B4
C5
C#5
D5
D#5
E5
F5
F#5
G5
G#5
A5
A#5
B5
C6
F2
F#2
G2
G#2
A2
A#2
B2
IC194
Decoder
A.O.C.
Genie
Or Magic
Keyswitches 5 & 19
R/S Dwgs.
Keyboard See
Lower
From
Inputs
Q555
Q556
Q557
Q558
Q559
Q560
Q561
Q562
Q563
Q564
Q565
Q566
Q567
Q568
Q569
Q570
Q571
Q572
Q573
Q574
Q575
Q576
Q577
Q578
10K
1M
A
G#
G
F#
F
E
D#
D
C#
C
B
A#
(N2) Golden Harp Enable To Harp Enable Line & To Harp Data Enable Gate IC122B Pin 1 See Dwgs. 28 & 13
D891
Q554
GOLDEN HARP ENABLE SWITCHER
DRIVER ENABLE
+13.5V
3.3K
100K
15K
A.O.C. RANGE REGULATOR
Q552
Q553
5K
22K
A.O.C. Range Adj. VR57

SCHEMATIC 28


Reset When Low
VIRTUOSO PULSE DIVIDERS
IC237A
IC237B
VIRTUOSO DIRECTION GATE
IC238A
IC239A
INVERTER
UP/DOWN COUNT ENABLE GATES
IC239B
IC239C
IC239D
Up/Down Count Enable Line
High = Up Count, Low = Down Count
IC240A
INVERTER
D897
D898
D899
D900
Transfer Pulse Swallower Trigger Line
All I.C's Unless Otherwise Specified
Pin 14 = +14V
Pin 7 = GND
VIRTUOSO ENABLE SWITCHER & RESET
Q581
Virtuoso
P5
TRANSFER PULSE SWALLOWER
IC243B
PULSE SWALLOWER RESET
D913
IC240C
STOP SCAN TRIGGERS
IC241A
IC241B
STOP SCAN
IC243A
IC243 Pin 16 = +14V
Pin 8 = GND
D904
D903
Rhythm Sync.
HARP SPEED OSCILLATOR
IC238B
IC240B
INVERTER
Q579
N3
N6
N7
N8
N9
VR60 500K
Harp Speed Control
N5
Located at Tab Panel
Rhythm on Osc. Disable From Q351 Pt. SC See Dwg. 19
÷2 Rhythm Clock From IC189A Pt. SD See Dwg. 19
IC238C
IC238D
SCAN OSCILLATOR
Q580
From Magic Chord "On" Switcher Q348 Pt. RW (Low with Magic Chord on) See Dwg. 19
HARP FOOTSWITCH ENABLE
From Minor / Golden Harp Footswitch Pt. RR (Low when Footswitch activated) See Dwg. 19
D894
D895
From Magic Chord Tab Pt. RU (High with Magic Chord On) See Dwg. 19
N4
D896
Golden Harp
D905
Down Only
Harp Enable & Reset Line
Up
P3
Octave Count Enable Line
Down Only Octave Count Enable Line
Down
P2
P4
UP/DOWN COUNT DRIVER
Q582
On = Down Count
Off = Up Count
Octave Up/Down Count Enable Line
High = Up Count, Low = Down Count
IC240D
OCTAVE COUNT TRIGGER
DOWN ONLY-HIGH OCTAVE ENABLE
IC242A
UP ONLY-HIGH OCTAVE ENABLE
IC242B
D911
D912
IC242D
UP/DOWN 3 - HIGH OCTAVE UP & DOWN ENABLE
OCTAVE COUNTER IC244
OCTAVE COUNT DECODER IC245
IC242C
UP/DOWN 2- MIDDLE OCTAVE DOWN ENABLE
From Golden Harp Enable Switcher Q554 Pt. N2 (Low enable when lower keyswitch is Pressed) See Dwg. 27
D906
Up/Down 3 - Reset Line
UP ONLY/DOWN ONLY RESET
D907
IC241C
D908
IC241D
UP/DOWN 2 RESET
D909
P7
D910
P6
P8
Up/Down 2
P9
Up/Down 3
S2
+14V

SCHEMATIC 28



Stop Scan Enable Line
22K
100 K
From C# A.O.C. Drivers Q561 & Q562 See Dwg. 27
2.2K
Q583 (12)
C# ENABLE
Harp Key Information To C# Input Harp Data Collectors IC104 Pin 8 See Dwg. 12
GOLDEN HARP KEYERS
+24V
470Ω
Q584 (36)
D914 (12)
47K
D915 (36)
D916 (36)
C#3
C#4
C#5
2 of 12 Identical Circuits
To Upper R/S Diode Keying Circuits See Dwg. 2
+14V
UP/DOWN COUNTER
IC246
UP/DOWN DECODER
IC247
.1
To D Enable
To D# Enable
To E Enable
To F Enable
To F# Enable
To G Enable
To G# Enable
To A Enable
To A# Enable
To B Enable
From C A.O.C. Drivers Q555 & Q556 See Dwg. 27
C ENABLE
Harp Key Information To C Input Harp Data Collectors IC106 Pin 1 See Dwg. 12
C4
C5
C6
HIGH OCTAVE SWITCHERS
Q585
Q586
10K
100K
High Octave Enable Line
150K
Q587
LOW OCTAVE SWITCHER
Low Octave Enable Line
MIDDLE OCTAVE SWITCHERS
Q588
Q589
Middle Octave Enable Line
S3
S4
S6
High Octave Information To Flute Encoder IC132A Pin 8 See Dwg. 13
Low Octave Information To Flute Encoder IC132C Pin 11 See Dwg. 13
Middle Octave Information To Flute Encoder IC132B Pin 5 See Dwg. 13

NOTES:

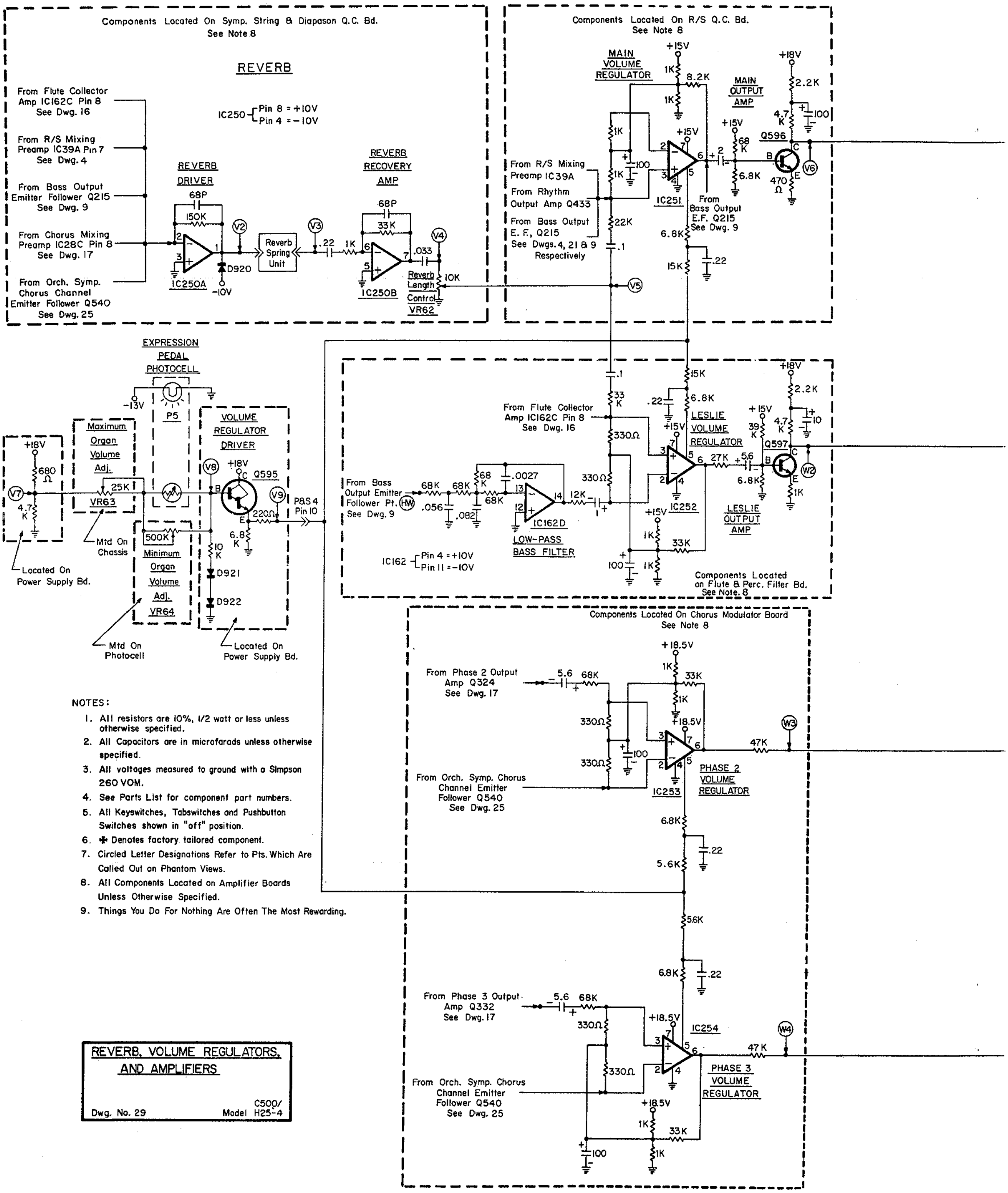
1. All resistors are 10%, 1/2 watt or less unless otherwise specified.
2. All Capacitors are in microfarads unless otherwise specified.
3. All voltages measured to ground with a Simpson 260 VOM.
4. See Parts List for component part numbers.
5. All Keyswitches, Tabswitches and Pushbutton Switches shown in "off" position.
6. ✚ Denotes factory tailored component.
7. All components located on Golden Harp board unless otherwise specified.

GOLDEN HARP

Dwg. No. 28

C500/
Model H25-4

SCHEMATIC 29


Components Located On Symp. String & Diapason Q.C. Bd.
See Note 8
REVERB
IC250 Pin 8 = +10V
Pin 4 = −10V
From Flute Collector Amp IC162C Pin 8 See Dwg. 16
From R/S Mixing Preamp IC39A Pin 7 See Dwg. 4
From Bass Output Emitter Follower Q215 See Dwg. 9
From Chorus Mixing Preamp IC28C Pin 8 See Dwg. 17
From Orch. Symp. Chorus Channel Emitter Follower Q540 See Dwg. 25
REVERB DRIVER
68P
150K
IC250A
−10V
D920
V2
V3
V4
Reverb Spring Unit
.22
1K
REVERB RECOVERY AMP
68P
33K
.033
IC250B
Reverb Length Control VR62
10K
Components Located On R/S Q.C. Bd.
See Note 8
+15V
MAIN VOLUME REGULATOR
1K
8.2K
1K
1K
1K
100
IC251
+15V
From R/S Mixing Preamp IC39A
From Rhythm Output Amp Q433
From Bass Output E. F., Q215
See Dwgs. 4, 21 & 9 Respectively
22K
.1
From Bass Output E.F. Q215 See Dwg. 9
6.8K
15K
.22
MAIN OUTPUT AMP
+15V
68K
6.8K
2
+18V
2.2K
4.7K
100
Q596
470Ω
V5
V6
EXPRESSION PEDAL PHOTOCELL
−13V
P5
+18V
680Ω
4.7K
V7
Maximum Organ Volume Adj.
25K
VR63
Mtd On Chassis
Located On Power Supply Bd.
500K
Minimum Organ Volume Adj. VR64
Mtd On Photocell
VOLUME REGULATOR DRIVER
V8
+18V
Q595
V9
220Ω
6.8K
10K
D921
D922
P8S4 Pin 10
Located On Power Supply Bd.
.1
15K
33K
.22
6.8K
From Flute Collector Amp IC162C Pin 8 See Dwg. 16
330Ω
330Ω
+15V
LESLIE VOLUME REGULATOR
IC252
27K
5.6
+15V
39K
4.7K
+18V
2.2K
10
Q597
6.8K
1K
W2
LESLIE OUTPUT AMP
From Bass Output Emitter Follower Pt. See Dwg. 9
HW
68K
68K
68K
68K
.0027
.056
.082
IC162D
LOW-PASS BASS FILTER
12K
IC162 Pin 4 = +10V
Pin 11 = −10V
+15V
1K
33K
100
1K
Components Located on Flute & Perc. Filter Bd.
See Note 8
Components Located On Chorus Modulator Board
See Note 8
+18.5V
From Phase 2 Output Amp Q324 See Dwg. 17
5.6
68K
1K
33K
1K
+18.5V
330Ω
330Ω
100
From Orch. Symp. Chorus Channel Emitter Follower Q540 See Dwg. 25
IC253
47K
W3
PHASE 2 VOLUME REGULATOR
6.8K
.22
5.6K
5.6K
6.8K
.22
From Phase 3 Output Amp Q332 See Dwg. 17
5.6
68K
330Ω
+18.5V
IC254
47K
W4
330Ω
PHASE 3 VOLUME REGULATOR
From Orch. Symp. Chorus Channel Emitter Follower Q540 See Dwg. 25
+18.5V
1K
33K
100
1K

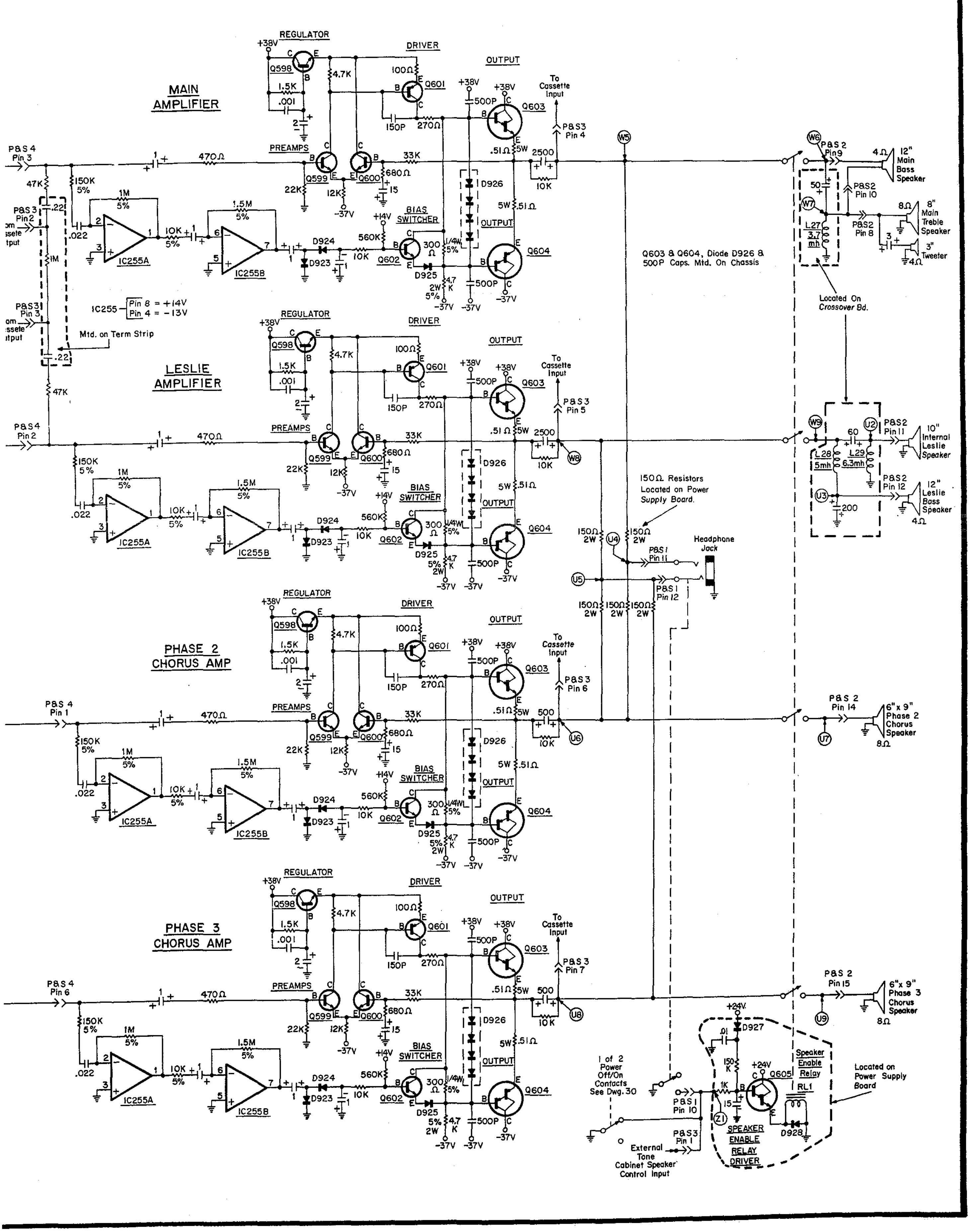
NOTES:

1. All resistors are 10%, 1/2 watt or less unless otherwise specified.
2. All Capacitors are in microfarads unless otherwise specified.
3. All voltages measured to ground with a Simpson 260 VOM.
4. See Parts List for component part numbers.
5. All Keyswitches, Tabswitches and Pushbutton Switches shown in "off" position.
6. ✚ Denotes factory tailored component.
7. Circled Letter Designations Refer to Pts. Which Are Called Out on Phantom Views.
8. All Components Located on Amplifier Boards Unless Otherwise Specified.
9. Things You Do For Nothing Are Often The Most Rewarding.

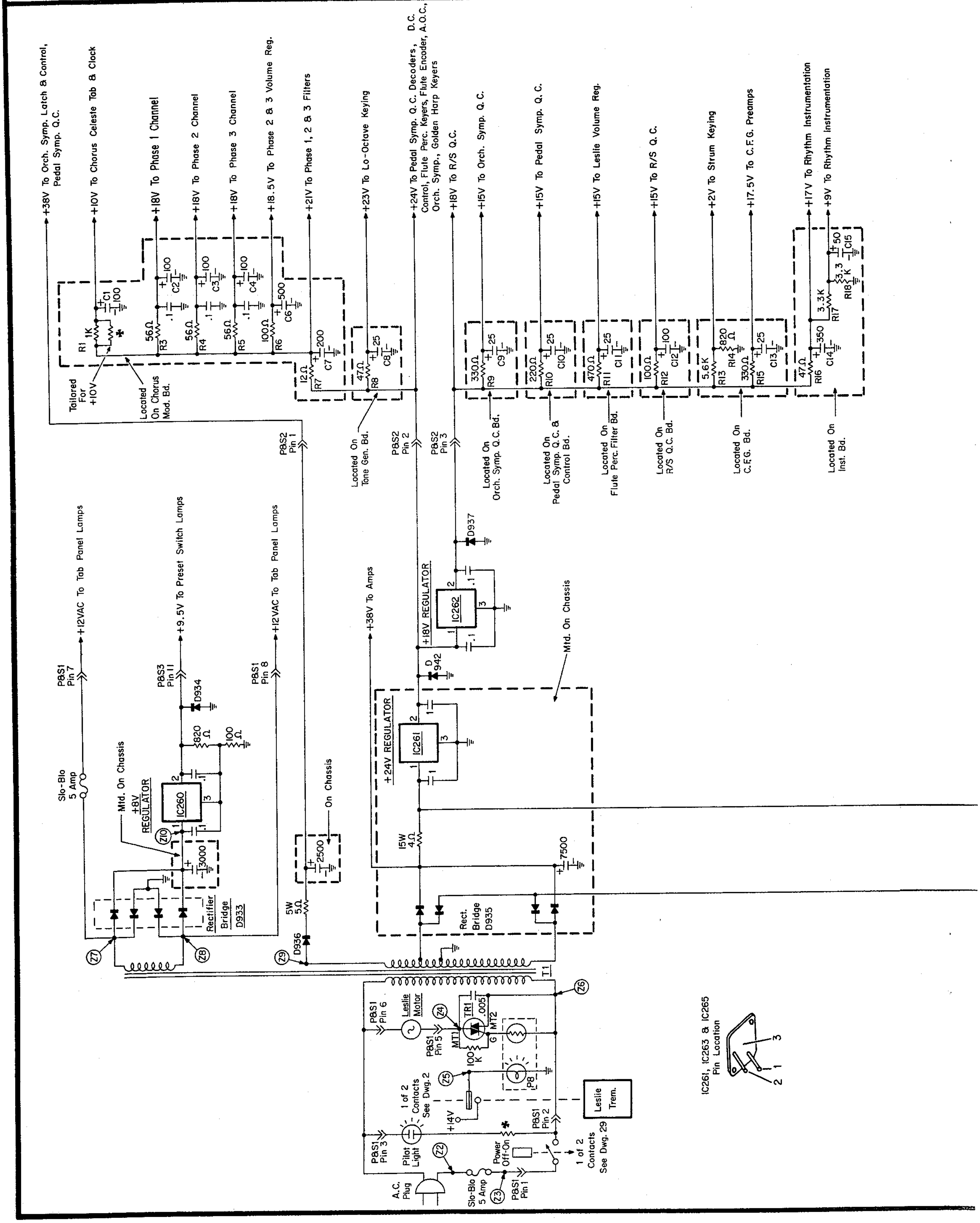
REVERB, VOLUME REGULATORS, AND AMPLIFIERS

Dwg. No. 29
C500/
Model H25-4

SCHEMATIC 29


MAIN AMPLIFIER
LESLIE AMPLIFIER
PHASE 2 CHORUS AMP
PHASE 3 CHORUS AMP
REGULATOR
DRIVER
OUTPUT
PREAMPS
BIAS SWITCHER
Q598
Q599
Q600
Q601
Q602
Q603
Q604
IC255A
IC255B
D923
D924
D925
D926
+38V
+14V
-37V
To Cassette Input
P&S3 Pin 4
P&S3 Pin 5
P&S3 Pin 6
P&S3 Pin 7
P&S4 Pin 3
P&S4 Pin 2
P&S4 Pin 1
P&S4 Pin 6
P&S3 Pin 2
P&S3 Pin 3
IC255 Pin 8 = +14V
Pin 4 = -13V
Mtd. on Term Strip
Q603 & Q604, Diode D926 & 500P Caps. Mtd. On Chassis
150Ω Resistors Located on Power Supply Board.
Headphone Jack
P&S1 Pin 11
P&S1 Pin 12
P&S2 Pin 9
P&S2 Pin 10
P&S2 Pin 8
P&S2 Pin 11
P&S2 Pin 12
P&S2 Pin 14
P&S2 Pin 15
4Ω 12" Main Bass Speaker
8Ω 8" Main Treble Speaker
3" Tweeter 4Ω
L27 3.7 mh
Located On Crossover Bd.
L28 5mh
L29 6.3mh
10" Internal Leslie Speaker
12" Leslie Bass Speaker 4Ω
6"x 9" Phase 2 Chorus Speaker 8Ω
6"x 9" Phase 3 Chorus Speaker 8Ω
W5
W6
W7
W8
W9
U2
U3
U4
U5
U6
U7
U8
U9
Z1
1 of 2 Power Off/On Contacts See Dwg. 30
P&S1 Pin 10
P&S3 Pin 1
External Tone Cabinet Speaker Control Input
+24V
D927
D928
Q605
Speaker Enable Relay RL1
SPEAKER ENABLE RELAY DRIVER
Located on Power Supply Board

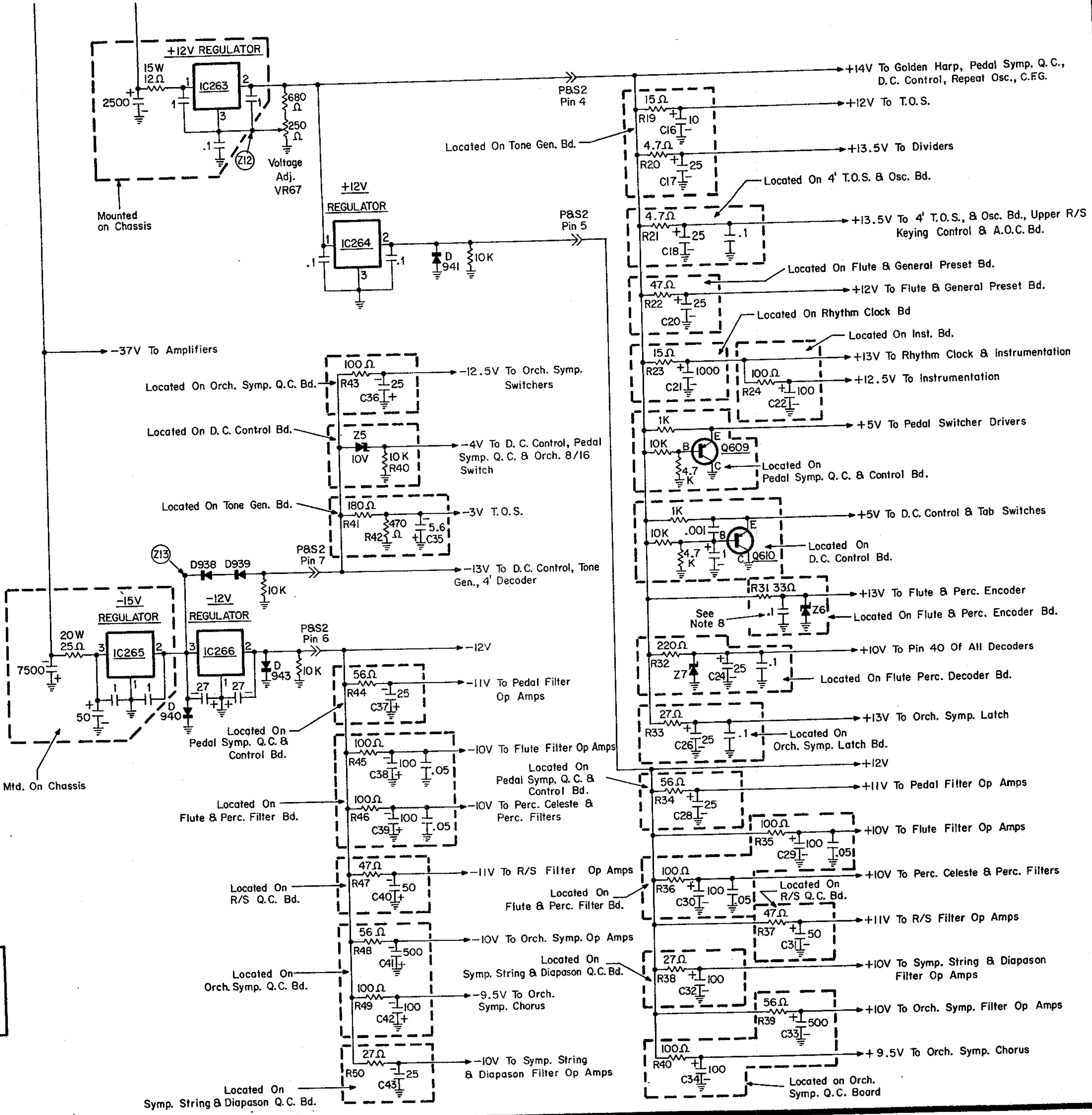
SCHEMATIC 30


+38V To Orch. Symp. Latch & Control, Pedal Symp. Q.C.
+10V To Chorus Celeste Tab & Clock
+18V To Phase 1 Channel
+18V To Phase 2 Channel
+18V To Phase 3 Channel
+18.5V To Phase 2 & 3 Volume Reg.
+21V To Phase 1, 2 & 3 Filters
+23V To Lo-Octave Keying
+24V To Pedal Symp. Q.C. Decoders, D.C. Control, Flute Perc. Keyers, Flute Encoder, A.O.C., Orch. Symp., Golden Harp Keyers
+18V To R/S Q.C.
+15V To Orch. Symp. Q.C.
+15V To Pedal Symp. Q.C.
+15V To Leslie Volume Reg.
+15V To R/S Q.C.
+2V To Strum Keying
+17.5V To C.F.G. Preamps
+17V To Rhythm Instrumentation
+9V To Rhythm Instrumentation
R1 1K
*
C1 100
56Ω R3
56Ω R4
56Ω R5
100Ω R6
C2 100
C3 100
C4 100
C6 500
.1
12Ω R7
C7 200
47Ω R8
C8 25
330Ω R9
C9 25
220Ω R10
C10 25
470Ω R11
C11 25
100Ω R12
C12 100
5.6K R13
820 Ω R14
330Ω R15
C13 25
47Ω R16
C14 350
3.3K R17
3.3 K R18
C15 50
Tailored For +10V
Located On Chorus Mod. Bd.
Located On Tone Gen. Bd.
Located On Orch. Symp. Q.C. Bd.
Located On Pedal Symp. Q.C. & Control Bd.
Located On Flute Perc. Filter Bd.
Located On R/S Q.C. Bd.
Located On C.F.G. Bd.
Located On Inst. Bd.
P8S2 Pin 1
P8S2 Pin 2
P8S2 Pin 3
+12VAC To Tab Panel Lamps
+9.5V To Preset Switch Lamps
+12VAC To Tab Panel Lamps
+38V To Amps
P8S1 Pin 7
P8S3 Pin 11
P8S1 Pin 8
D934
820 Ω
100 Ω
Slo-Blo 5 Amp
Mtd. On Chassis
+8V REGULATOR
IC260
1 2 3
.1
Z10
3000
Rectifier Bridge D933
Z7
Z8
2500
On Chassis
5W 5Ω
D936
Z9
D937
+18V REGULATOR
IC262
D 942
Mtd. On Chassis
+24V REGULATOR
IC261
15W 4Ω
7500
Rect. Bridge D935
T1
Z6
P8S1 Pin 6
Leslie Motor
Z4
TR1
.005
MT1
MT2
G
P8S1 Pin 5
100 K
Z5
P8
1 of 2 Contacts See Dwg. 2
+14V
Leslie Trem.
P8S1 Pin 2
1 of 2 Contacts See Dwg. 29
P8S1 Pin 3
Pilot Light
Z2
Power Off-On
A.C. Plug
Slo-Blo 5 Amp
Z3
P8S1 Pin 1
IC261, IC263 & IC265 Pin Location
1 2 3

SCHEMATIC 30

NOTES:

1. All resistors are 10%, 1/2 watt or less unless otherwise specified.
2. All Capacitors are in microfarads unless otherwise specified.
3. All voltages measured to ground with a Simpson 260 VOM.
4. See Parts List for component part numbers.
5. All Keyswitches, Tabswitches and Pushbutton Switches shown in "off" position.
6. ✤ Denotes factory tailored component.
7. All components located on Power Supply Board unless otherwise specified.
8. Represents 1 of 7 .1 capacitors located on Flute Encoder Board. See phanthom view for specific locations.



+12V REGULATOR
IC263
15W 12Ω
2500
680 Ω
250 Ω
Voltage Adj. VR67
Z12
Mounted on Chassis
+12V REGULATOR
IC264
D 941
10K
P&S2 Pin 4
P&S2 Pin 5
-37V To Amplifiers
+14V To Golden Harp, Pedal Symp. Q.C., D.C. Control, Repeat Osc., C.F.G.
Located On Tone Gen. Bd.
R19 15Ω C16 10
+12V To T.O.S.
R20 4.7Ω C17 25
+13.5V To Dividers
Located On 4' T.O.S. & Osc. Bd.
R21 4.7Ω C18 25
+13.5V To 4' T.O.S., & Osc. Bd., Upper R/S Keying Control & A.O.C. Bd.
Located On Flute & General Preset Bd.
R22 47Ω C20 25
+12V To Flute & General Preset Bd.
Located On Rhythm Clock Bd
Located On Inst. Bd.
R23 15Ω C21 1000
+13V To Rhythm Clock & Instrumentation
R24 100Ω C22 100
+12.5V To Instrumentation
1K 10K 4.7K Q609
+5V To Pedal Switcher Drivers
Located On Pedal Symp. Q.C. & Control Bd.
1K 10K .001 4.7K Q610
+5V To D.C. Control & Tab Switches
Located On D.C. Control Bd.
R31 33Ω Z6
+13V To Flute & Perc. Encoder
See Note 8
Located On Flute & Perc. Encoder Bd.
R32 220Ω Z7 C24 25
+10V To Pin 40 Of All Decoders
Located On Flute Perc. Decoder Bd.
R33 27Ω C26 25
+13V To Orch. Symp. Latch
Located On Orch. Symp. Latch Bd.
+12V
R34 56Ω C28 25
+11V To Pedal Filter Op Amps
Located On Pedal Symp. Q.C. & Control Bd.
R35 100Ω C29 100 .05
+10V To Flute Filter Op Amps
R36 100Ω C30 100 .05
+10V To Perc. Celeste & Perc. Filters
Located On Flute & Perc. Filter Bd.
Located On R/S Q.C. Bd.
R37 47Ω C31 50
+11V To R/S Filter Op Amps
R38 27Ω C32 100
+10V To Symp. String & Diapason Filter Op Amps
Located On Symp. String & Diapason Q.C. Bd.
R39 56Ω C33 500
+10V To Orch. Symp. Filter Op Amps
R40 100Ω C34 100
+9.5V To Orch. Symp. Chorus
Located on Orch. Symp. Q.C. Board
R43 100Ω C36 25
-12.5V To Orch. Symp. Switchers
Located On Orch. Symp. Q.C. Bd.
Z5 10V 10K R40
-4V To D.C. Control, Pedal Symp. Q.C. & Orch. 8/16 Switch
Located On D.C. Control Bd.
R41 180Ω R42 470Ω C35 5.6
-3V T.O.S.
Located On Tone Gen. Bd.
P&S2 Pin 7
-13V To D.C. Control, Tone Gen., 4' Decoder
Z13
D938 D939
10K
-15V REGULATOR
IC265
20W 25Ω
7500
50
Mtd. On Chassis
-12V REGULATOR
IC266
27 27
D 940
D 943
10K
P&S2 Pin 6
-12V
R44 56Ω C37 25
-11V To Pedal Filter Op Amps
Located On Pedal Symp. Q.C. & Control Bd.
R45 100Ω C38 100 .05
-10V To Flute Filter Op Amps
R46 100Ω C39 100 .05
-10V To Perc. Celeste & Perc. Filters
Located On Flute & Perc. Filter Bd.
R47 47Ω C40 50
-11V To R/S Filter Op Amps
Located On R/S Q.C. Bd.
R48 56Ω C41 500
-10V To Orch. Symp. Op Amps
R49 100Ω C42 100
-9.5V To Orch. Symp. Chorus
Located On Orch. Symp. Q.C. Bd.
R50 27Ω C43 25
-10V To Symp. String & Diapason Filter Op Amps
Located On Symp. String & Diapason Q.C. Bd.

POWER SUPPLY

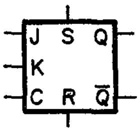
Dwg. No. 30

C500/
Model H25-4

TRUTH TABLES

LOWREY PART NO.	MFG PART NO.	MFG	FIG
991-025225	(MM)74C74	NATIONAL	2
991-026005	(MM)74C86	NATIONAL	13
991-025536	(MM)74C02	NATIONAL	12
991-025516	(CD)4071	RCA	11
991-025517	(CD)4081	RCA	9
991-025515	(CD)4011	RCA	10
991-024593	(MM)74C00	NATIONAL	10
991-026006	(MC)14520	MOTOROLA	3
991-026025	(CD)4001	RCA	12
991-026022	(CD)4027	RCA	1
991-026023	(CD)4028	RCA	7
991-024595	(MM)74C154	NATIONAL	14
991-025599	(MC)14532	MOTOROLA	8
991-026616	(CD)4514	RCA	4
991-026605	(CD)4023	RCA	6
991-026606	(CD)4075	RCA	5
991-026604	(MC)74C08	NATIONAL	9

FIG. 1

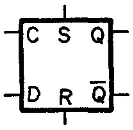


J-K FLIP-FLOP

T_n					T_n+1	
J	K	S	R	Clk	Q	$\overline{Q}$
1	0	0	0	↑	1	0
0	1	0	0	↑	0	1
0	0	0	0	↑	Q_n	$\overline{Q}_n$
1	1	0	0	↑	$\overline{Q}_n$	Q_n
X	X	0	1	X	0	1
X	X	1	0	X	1	0
X	X	1	1	X	1	1

X = Don't Care

FIG. 2



D FLIP-FLOP

T_n				T_n+1
D	S	R	Clk	Q
1	1	1	↑	1
0	1	1	↑	0
X	0	1	X	1
X	1	0	X	0
–	0	0	–	NOT DEF.

X = Don't Care

FIG. 3

CLOCK	ENABLE	RESET	ACTION
↑	1	0	Counter
0	↓	0	Counter
↑	0	0	No Change
1	↓	0	No Change
X	X	1	Q1–Q4=0

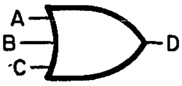
X = Don't Care

FIG. 4

	INH.	INPUT				OUTPUT															
Pin Nos.→	23	22	21	3	2	11	9	10	8	7	6	5	4	18	17	20	19	14	13	16	15
	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	0	0	1	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	0	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	1	X	X	X	X	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

X = Don't Care

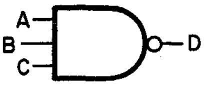
FIG. 5



TRIPLE-INPUT OR

A	B	C	D
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	1

FIG. 6



TRIPLE-INPUT NAND

A	B	C	D
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

TRUTH TABLES

FIG. 7

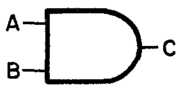
	INPUT				OUTPUT									
Pin Nos.	11	12	13	10	3	14	2	15	1	6	7	4	9	5
	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	0	0	0	1	0	1	0	0	0	0	0	0	0	0
	0	0	1	0	0	0	1	0	0	0	0	0	0	0
	0	0	1	1	0	0	0	1	0	0	0	0	0	0
	0	1	0	0	0	0	0	0	1	0	0	0	0	0
	0	1	0	1	0	0	0	0	0	1	0	0	0	0
	0	1	1	0	0	0	0	0	0	0	1	0	0	0
	0	1	1	1	0	0	0	0	0	0	0	1	0	0
	1	0	0	0	0	0	0	0	0	0	0	0	1	0
	1	0	0	1	0	0	0	0	0	0	0	0	0	1

FIG. 8

	INPUT									OUTPUT				
Pin Nos.	5	4	3	2	1	13	12	11	10	14	6	7	9	15
	0	X	X	X	X	X	X	X	X	0	0	0	0	0
	1	0	0	0	0	0	0	0	0	0	0	0	0	1
	1	1	X	X	X	X	X	X	X	1	1	1	1	0
	1	0	1	X	X	X	X	X	X	1	1	1	0	0
	1	0	0	1	X	X	X	X	X	1	1	0	1	0
	1	0	0	0	1	X	X	X	X	1	1	0	0	0
	1	0	0	0	0	1	X	X	X	1	0	1	1	0
	1	0	0	0	0	0	1	X	X	1	0	1	0	0
	1	0	0	0	0	0	0	1	X	1	0	0	1	0
	1	0	0	0	0	0	0	0	1	1	0	0	0	0

X = Don't Care

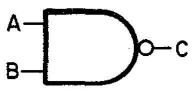
FIG. 9



AND

A	B	C
0	0	0
0	1	0
1	0	0
1	1	1

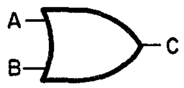
FIG. 10



NAND

A	B	C
0	0	1
0	1	1
1	0	1
1	1	0

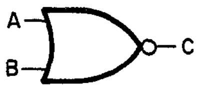
FIG. 11



OR

A	B	C
0	0	0
0	1	1
1	0	1
1	1	1

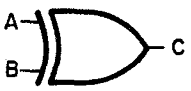
FIG. 12



NOR

A	B	C
0	0	1
0	1	0
1	0	0
1	1	0

FIG. 13



EXCLUSIVE OR

A	B	C
0	0	0
0	1	1
1	0	1
1	1	0

FIG. 14

	CONT.		INPUT				OUTPUT															
Pin Nos.	18	19	20	21	22	23	1	2	3	4	5	6	7	8	9	10	11	13	14	15	16	17
	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	0	0	0	0	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	0	0	0	0	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1
	0	0	0	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1
	0	0	0	1	0	0	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1
	0	0	0	1	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1
	0	0	0	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1
	0	0	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1
	0	0	1	0	0	0	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1
	0	0	1	0	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1
	0	0	1	0	1	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1
	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1
	0	0	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1
	0	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1
	0	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1
	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
	0	1	X	X	X	X	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	1	0	X	X	X	X	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	1	1	X	X	X	X	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

X = Don't Care

TRANSISTOR BASING DIAGRAM

FIG. A

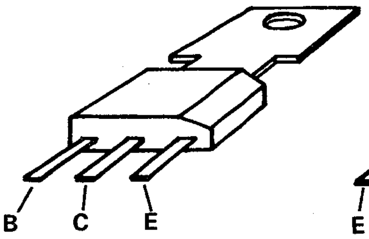


FIG. B

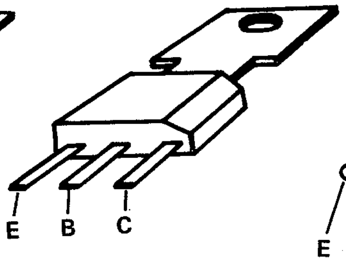


FIG. C

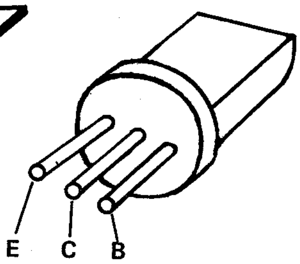


FIG. D

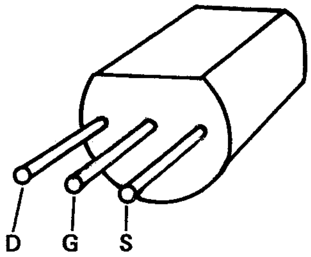


FIG. E

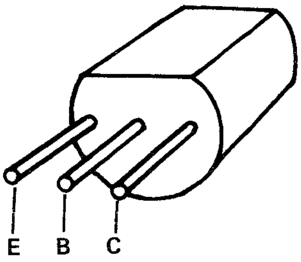


FIG. F

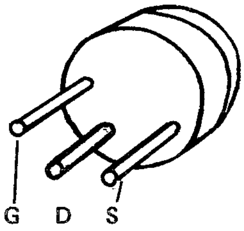


FIG. G

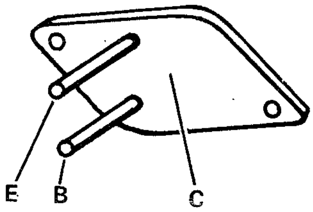


FIG. H

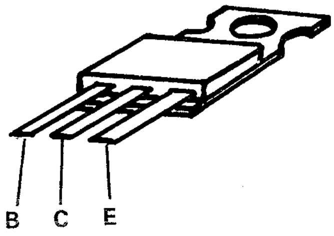


FIG. J

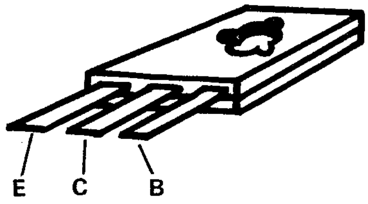


FIG. K

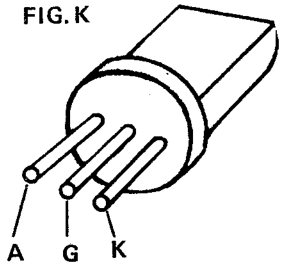


FIG. L

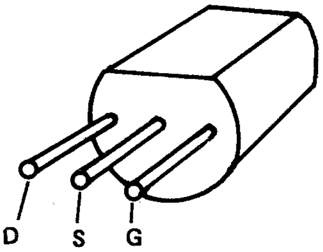
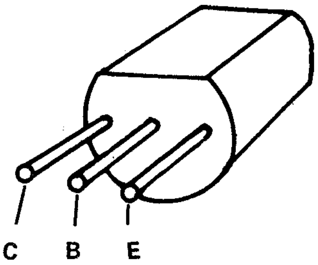


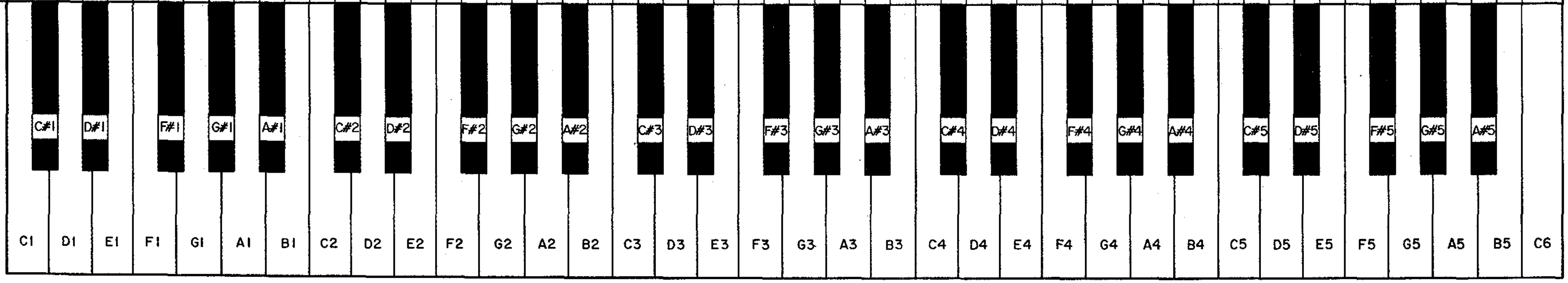
FIG. M



PART NUMBER	FIGURE	PART NUMBER	FIGURE	PART NUMBER	FIGURE	PART NUMBER	FIGURE
992-001192	G	991-012328	F	991-016727	C	992-024185	G
991-002232	C	991-012396	F	991-016788	C	991-024184	C
991-002271	G	991-012686	F	992-017169	G	991-025535	M
991-002298	C	992-013170	A	991-017456	F	991-026039	G
991-002356	C	991-013543	C	991-018238	C	991-026040	G
991-002873	C	991-013544	C	991-018047	E	991-026028	G
991-002888	C	991-013599	C	991-018237	B	991-026054	C
992-003139	G	991-015000	A	991-018493	E	991-026617	C
991-003304	C	991-015001	A	992-020432	G	991-026315	C
991-008393	C	991-015062	A	991-020425	H		
991-008394	C	991-015063	A	991-020426	H		
992-008890	G	991-015316	K	992-022201	G		
991-010098	C	991-015587	C	991-021451	J		
991-010462	C	991-015614	C	991-021450	J		
991-011576	D	991-015663	C	992-022773	G		
991-011706	D	991-016274	C	991-022774	L		

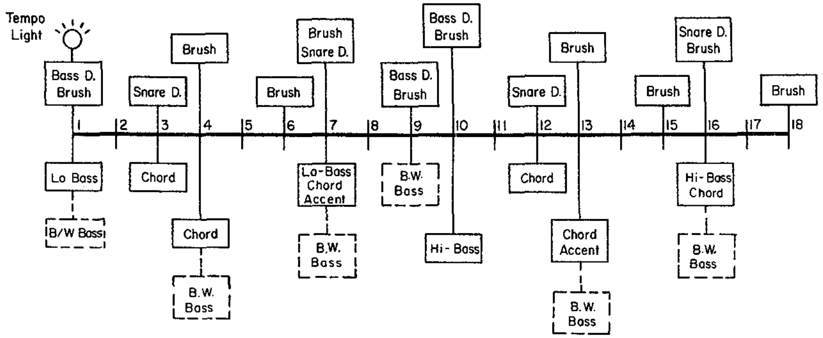
FREQUENCY DISTRIBUTION CHART

Voice Footages	Octave Frequency of Audio Signal																																																												
16'	C1	C#1	D1	D#1	E1	F1	F#1	G1	G#1	A1	A#1	B1	C2	C#2	D2	D#2	E2	F2	F#2	G2	G#2	A2	A#2	B2	C3	C#3	D3	D#3	E3	F3	F#3	G3	G#3	A3	A#3	B3	C4	C#4	D4	D#4	E4	F4	F#4	G4	G#4	A4	A#4	B4	C5	C#5	D5	D#5	E5	F5	F#5	G5	G#5	A5	A#5	B5	C6
8'	C2	C#2	D2	D#2	E2	F2	F#2	G2	G#2	A2	A#2	B2	C3	C#3	D3	D#3	E3	F3	F#3	G3	G#3	A3	A#3	B3	C4	C#4	D4	D#4	E4	F4	F#4	G4	G#4	A4	A#4	B4	C5	C#5	D5	D#5	E5	F5	F#5	G5	G#5	A5	A#5	B5	C6	C#6	D6	D#6	E6	F6	F#6	G6	G#6	A6	A#6	B6	C7
4'	C3	C#3	D3	D#3	E3	F3	F#3	G3	G#3	A3	A#3	B3	C4	C#4	D4	D#4	E4	F4	F#4	G4	G#4	A4	A#4	B4	C5	C#5	D5	D#5	E5	F5	F#5	G5	G#5	A5	A#5	B5	C6	C#6	D6	D#6	E6	F6	F#6	G6	G#6	A6	A#6	B6	C7	C#7	D7	D#7	E7	F7	F#7	G7	G#7	A7	A#7	B7	C8
2'	C4	C#4	D4	D#4	E4	F4	F#4	G4	G#4	A4	A#4	B4	C5	C#5	D5	D#5	E5	F5	F#5	G5	G#5	A5	A#5	B5	C6	C#6	D6	D#6	E6	F6	F#6	G6	G#6	A6	A#6	B6	C7	C#7	D7	D#7	E7	F7	F#7	G7	G#7	A7	A#7	B7	C8	C#8	D8	D#8	E8	F8	F#8	G8	G#8	A8	A#8	B8	C9
1'	C5	C#5	D5	D#5	D5	F5	F#5	G5	G#5	A5	A#5	B5	C6	C#6	D6	D#6	E6	F6	F#6	G6	G#6	A6	A#6	B6	C7	C#7	D7	D#7	E7	F7	F#7	G7	G#7	A7	A#7	B7	C8	C#8	D8	D#8	E8	F8	F#8	G8	G#8	A8	A#8	B8	C9	C#8	D8	D#8	E8	F8	F#8	G8	G#8	A8	A#8	B8	C9
5 1/3'	G2	G#2	A2	A#2	B2	C3	C#3	D3	D#3	E3	F3	F#3	G3	G#3	A3	A#3	B3	C4	C#4	D4	D#4	E4	F4	F#4	G4	G#4	A4	A#4	B4	C5	C#5	D5	D#5	E5	F5	F#5	G5	G#5	A5	A#5	B5	C6	C#6	D6	D#6	E6	F6	F#6	G6	G#6	A6	A#6	B6	C7	C#7	D7	D#7	E7	F7	F#7	G7
2 2/3'	G3	G#3	A3	A#3	B3	C4	C#4	D4	D#4	E4	F4	F#4	G4	G#4	A4	A#4	B4	C5	C#5	D5	D#5	E5	F5	F#5	G5	G#5	A5	A#5	B5	C6	C#6	D6	D#6	E6	F6	F#6	G6	G#6	A6	A#6	B6	C7	C#7	D7	D#7	E7	F7	F#7	G7	G#7	A7	A#7	B7	C8	C#8	D8	D#8	E8	F8	F#8	G8
1 3/5'	E4	F4	F#4	G4	G#4	A4	A#4	B4	C5	C#5	D5	D#5	E5	F5	F#5	G5	G#5	A5	A#5	B5	C6	C#6	D6	D#6	E6	F6	F#6	G6	G#6	A6	A#6	B6	C7	C#7	D7	D#7	E7	F7	F#7	G7	G#7	A7	A#7	B7	C8	C#8	D8	D#8	E8	F8	F#8	G8	G#8	A8	A#8	B8	C9	C#8	D8	D#8	E8
1 1/3'	G4	G#4	A4	A#4	B4	C5	C#5	D5	D#5	E5	F5	F#5	G5	G#5	A5	A#5	B5	C6	C#6	D6	D#6	E6	F6	F#6	G6	G#6	A6	A#6	B6	C7	C#7	D7	D#7	E7	F7	F#7	G7	G#7	A7	A#7	B7	C8	C#8	D8	D#8	E8	F8	F#8	G8	G 8	A8	A#8	B8	C9	C#8	D8	D#8	E8	F8	F#8	G8

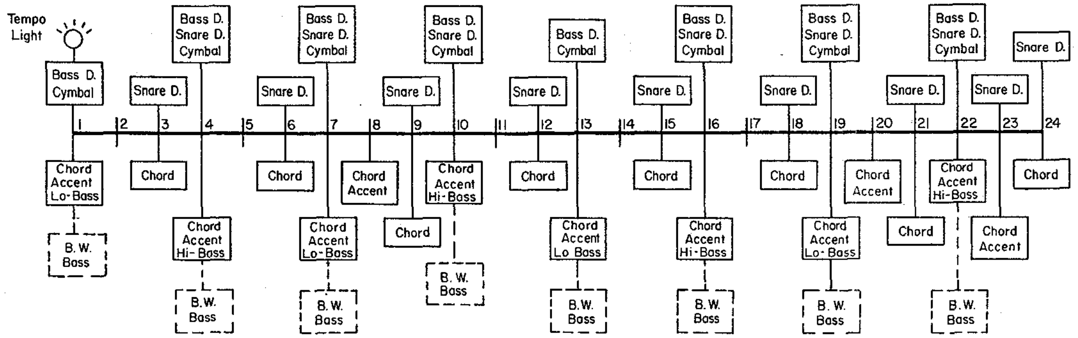


RHYTHM PATTERNS DIAGRAM

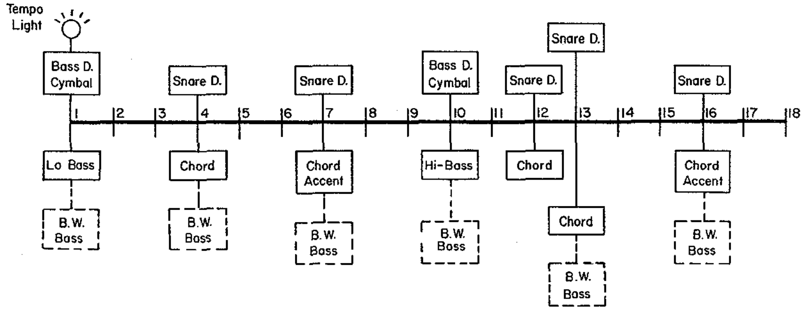
SWING WALTZ


Tempo Light
1
Bass D. Brush
Lo Bass
B/W Bass
2
3
Snare D.
Chord
4
Brush
Chord
B.W. Bass
5
6
Brush
7
Brush Snare D.
Lo-Bass Chord Accent
B.W. Bass
8
9
Bass D. Brush
B.W. Bass
10
Bass D. Brush
Hi-Bass
11
12
Snare D.
Chord
13
Brush
Chord Accent
B.W. Bass
14
15
Brush
16
Snare D. Brush
Hi-Bass Chord
B.W. Bass
17
18
Brush

SWING MARCH


Tempo Light
1
Bass D. Cymbal
Chord Accent Lo-Bass
B.W. Bass
2
3
Snare D.
Chord
4
Bass D. Snare D. Cymbal
Chord Accent Hi-Bass
B.W. Bass
5
6
Snare D.
Chord
7
Bass D. Snare D. Cymbal
Chord Accent Lo-Bass
B.W. Bass
8
Chord Accent
9
Snare D.
Chord
10
Bass D. Snare D. Cymbal
Chord Accent Hi-Bass
B.W. Bass
11
12
Snare D.
Chord
13
Bass D. Cymbal
Chord Accent Lo Bass
B.W. Bass
14
15
Snare D.
Chord
16
Bass D. Snare D. Cymbal
Chord Accent Hi-Bass
B.W. Bass
17
18
Snare D.
Chord
19
Bass D. Snare D. Cymbal
Chord Accent Lo-Bass
B.W. Bass
20
Chord Accent
21
Snare D.
Chord
22
Bass D. Snare D. Cymbal
Chord Accent Hi-Bass
B.W. Bass
23
Snare D.
Chord Accent
24
Snare D.
Chord

WALTZ

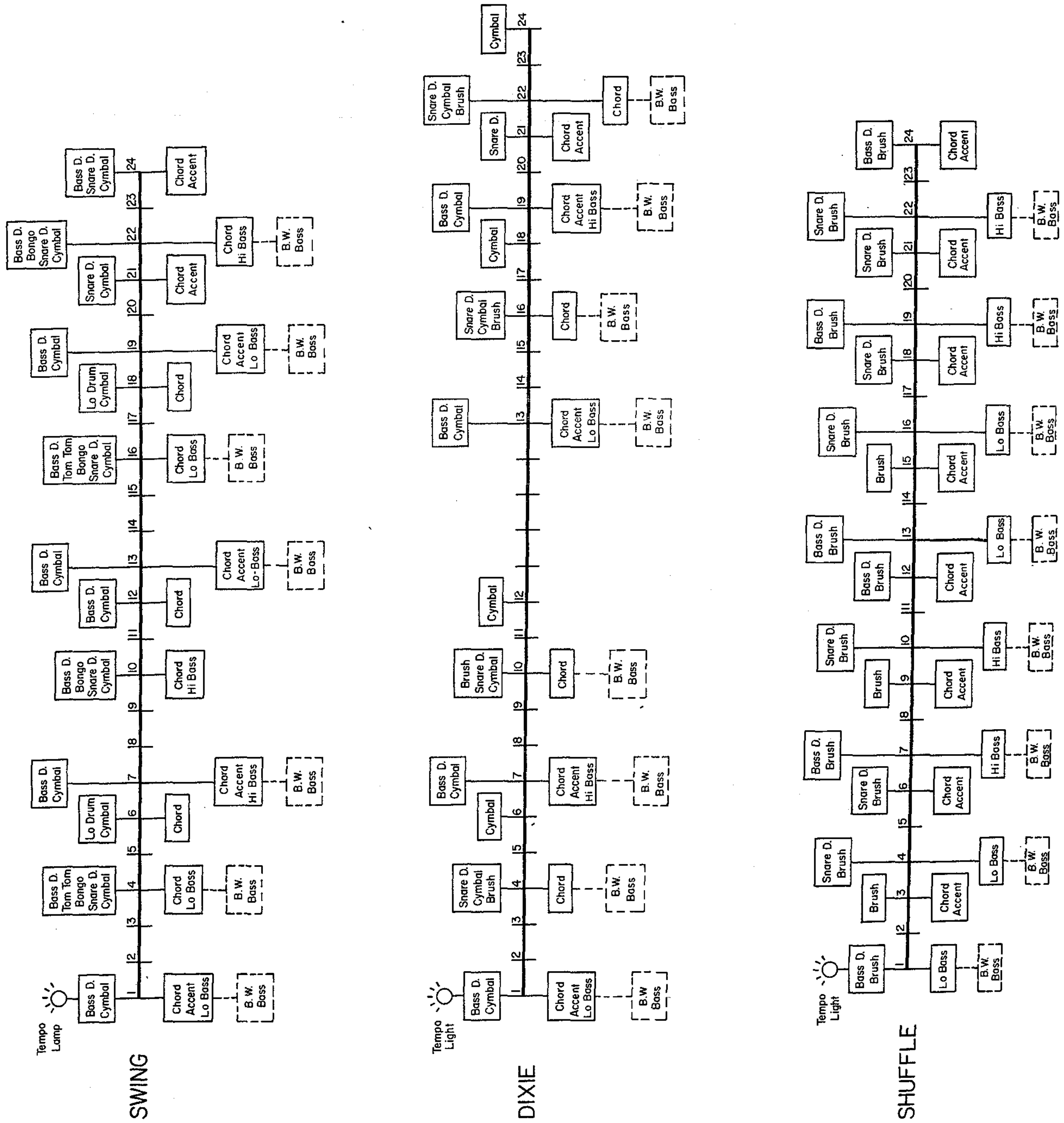

Tempo Light
1
Bass D. Cymbal
Lo Bass
B.W. Bass
2
3
4
Snare D.
Chord
B.W. Bass
5
6
7
Snare D.
Chord Accent
B.W. Bass
8
9
10
Bass D. Cymbal
Hi-Bass
B.W. Bass
11
12
Snare D.
Chord
13
Snare D.
Chord
B.W. Bass
14
15
16
Snare D.
Chord Accent
B.W. Bass
17
18

NOTE:

For Rhythms on this page and following page Strum Upbeat is coincident with Chord & Chord Accent pulse. Strum Downbeat is coincident with the Hi/Lo Bass Pulse or if B.W. Bass is on with the B.W. Bass Pulse, also Arpeggio is Triggered on every Rhythm Time Point.

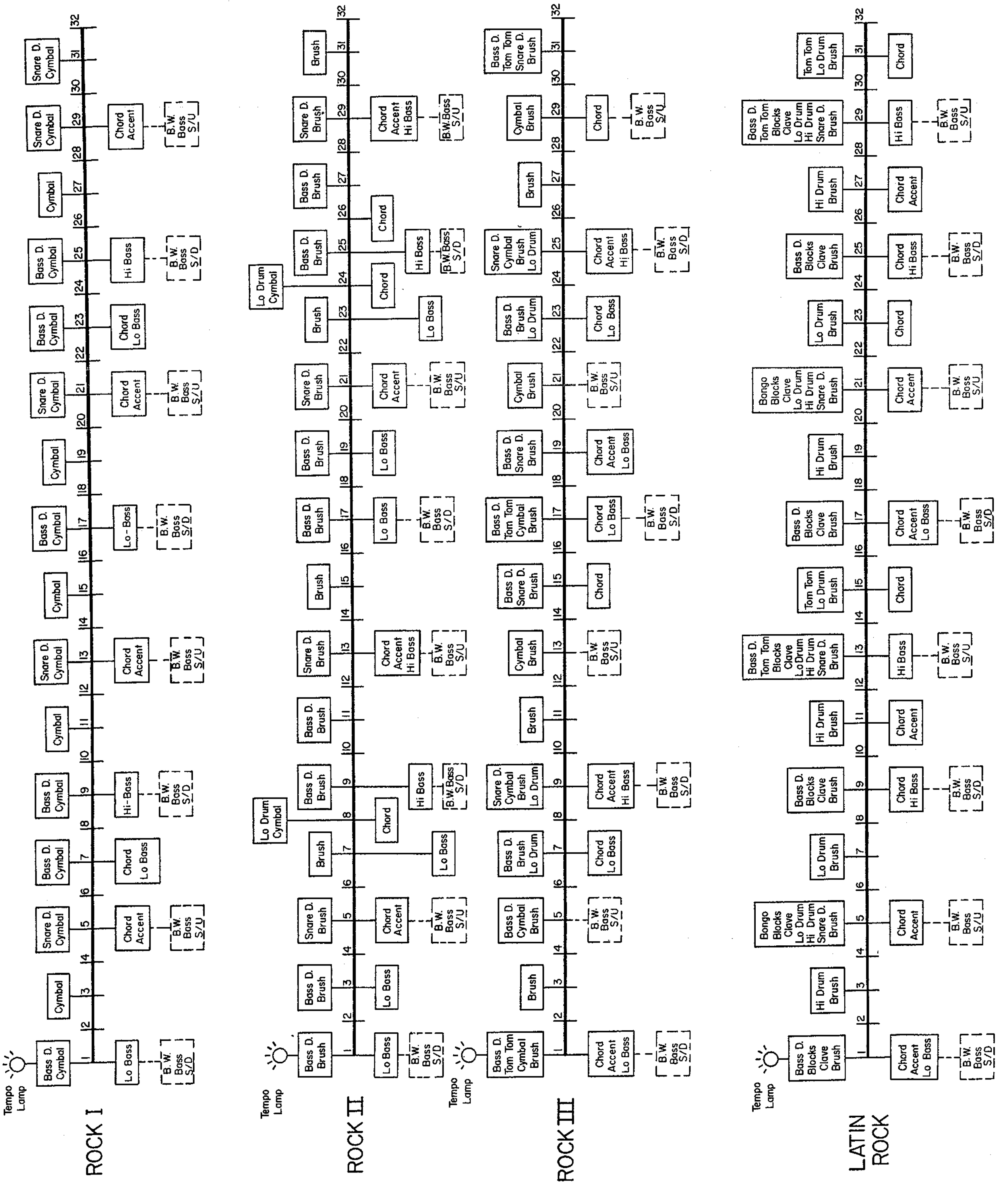
┌ ┐ Indicates functions with Magic Chord Tab on.

RHYTHM PATTERNS DIAGRAM


SWING
Tempo Lamp
Bass D. Cymbal
Chord Accent Lo Bass
B.W. Bass
Bass D. Tom Tom Bongo Snare D. Cymbal
Chord Lo Bass
B.W. Bass
Lo Drum Cymbal
Chord
Bass D. Cymbal
Chord Accent Hi Bass
B.W. Bass
Bass D. Bongo Snare D. Cymbal
Chord Hi Bass
Bass D. Cymbal
Chord
Bass D. Cymbal
Chord Accent Lo-Bass
B.W. Bass
Bass D. Tom Tom Bongo Snare D. Cymbal
Chord Lo Bass
B.W. Bass
Lo Drum Cymbal
Chord
Bass D. Cymbal
Chord Accent Lo Bass
B.W. Bass
Snare D. Cymbal
Chord Accent
Bass D. Bongo Snare D. Cymbal
Chord Hi Bass
B.W. Bass
Bass D. Snare D. Cymbal
Chord Accent
DIXIE
Tempo Light
Bass D. Cymbal
Chord Accent Lo Bass
B.W. Bass
Snare D. Cymbal Brush
Chord
B.W. Bass
Cymbal
Bass D. Cymbal
Chord Accent Hi Bass
B.W. Bass
Brush Snare D. Cymbal
Chord
B.W. Bass
Cymbal
Bass D. Cymbal
Chord Accent Lo Bass
B.W. Bass
Snare D. Cymbal Brush
Chord
B.W. Bass
Cymbal
Bass D. Cymbal
Chord Accent Hi Bass
B.W. Bass
Snare D.
Chord Accent
Snare D. Cymbal Brush
Chord
B.W. Bass
Cymbal
SHUFFLE
Tempo Light
Bass D. Brush
Lo Bass
B.W. Bass
Brush
Chord Accent
Snare D. Brush
Lo Bass
B.W. Bass
Snare D. Brush
Chord Accent
Bass D. Brush
Hi Bass
B.W. Bass
Brush
Chord Accent
Snare D. Brush
Hi Bass
B.W. Bass
Bass D. Brush
Chord Accent
Bass D. Brush
Lo Bass
B.W. Bass
Brush
Chord Accent
Snare D. Brush
Lo Bass
B.W. Bass
Snare D. Brush
Chord Accent
Bass D. Brush
Hi Bass
B.W. Bass
Snare D. Brush
Chord Accent
Snare D. Brush
Hi Bass
B.W. Bass
Bass D. Brush
Chord Accent

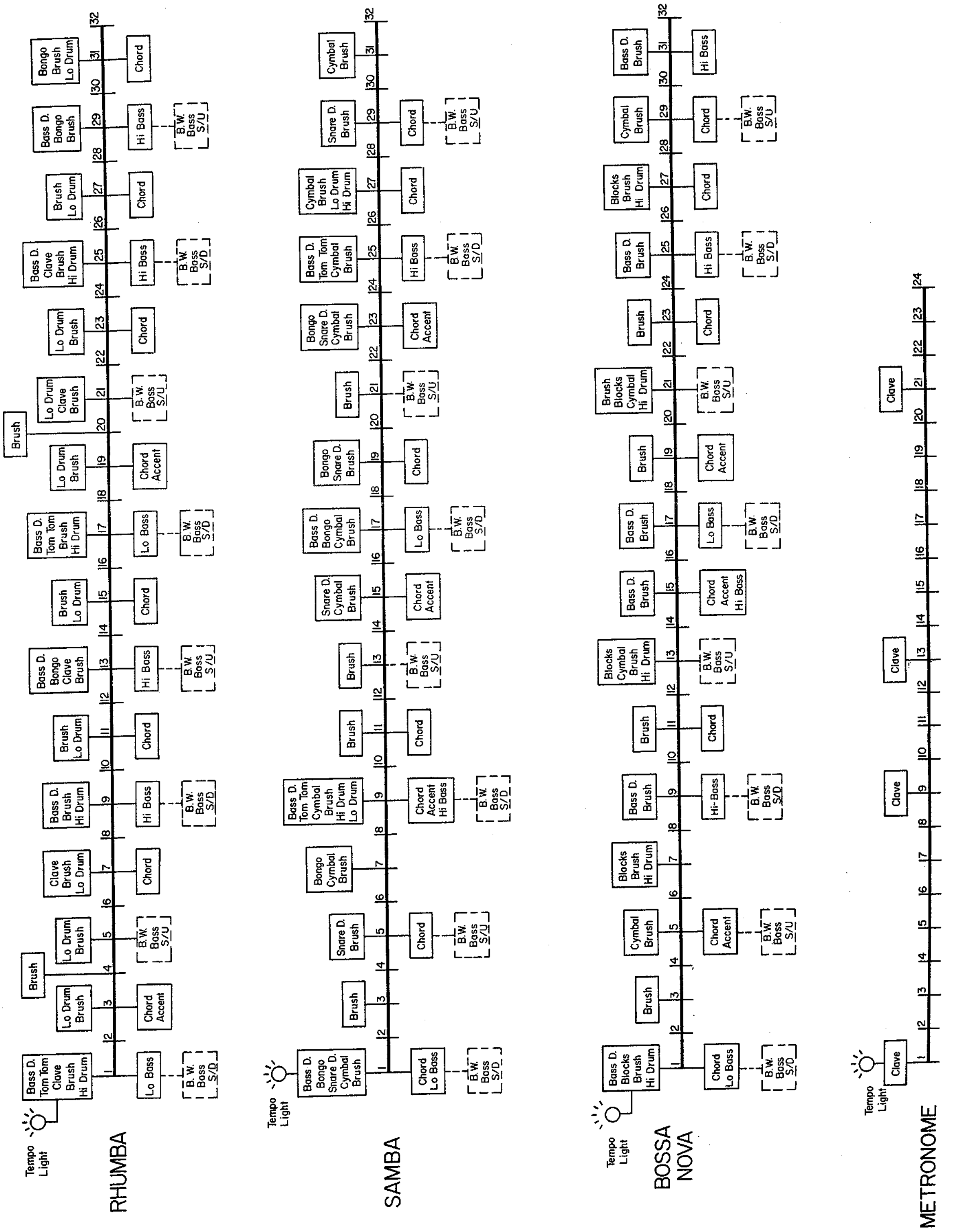
RHYTHM PATTERNS DIAGRAM

S/D= Strum Downbeat
S/U= Strum Upbeat
Indicates functions with magic Chord Tab on.
NOTE. For the Rhythms on this page & following pages Arpeggio is Triggered on all odd numbered time pts.

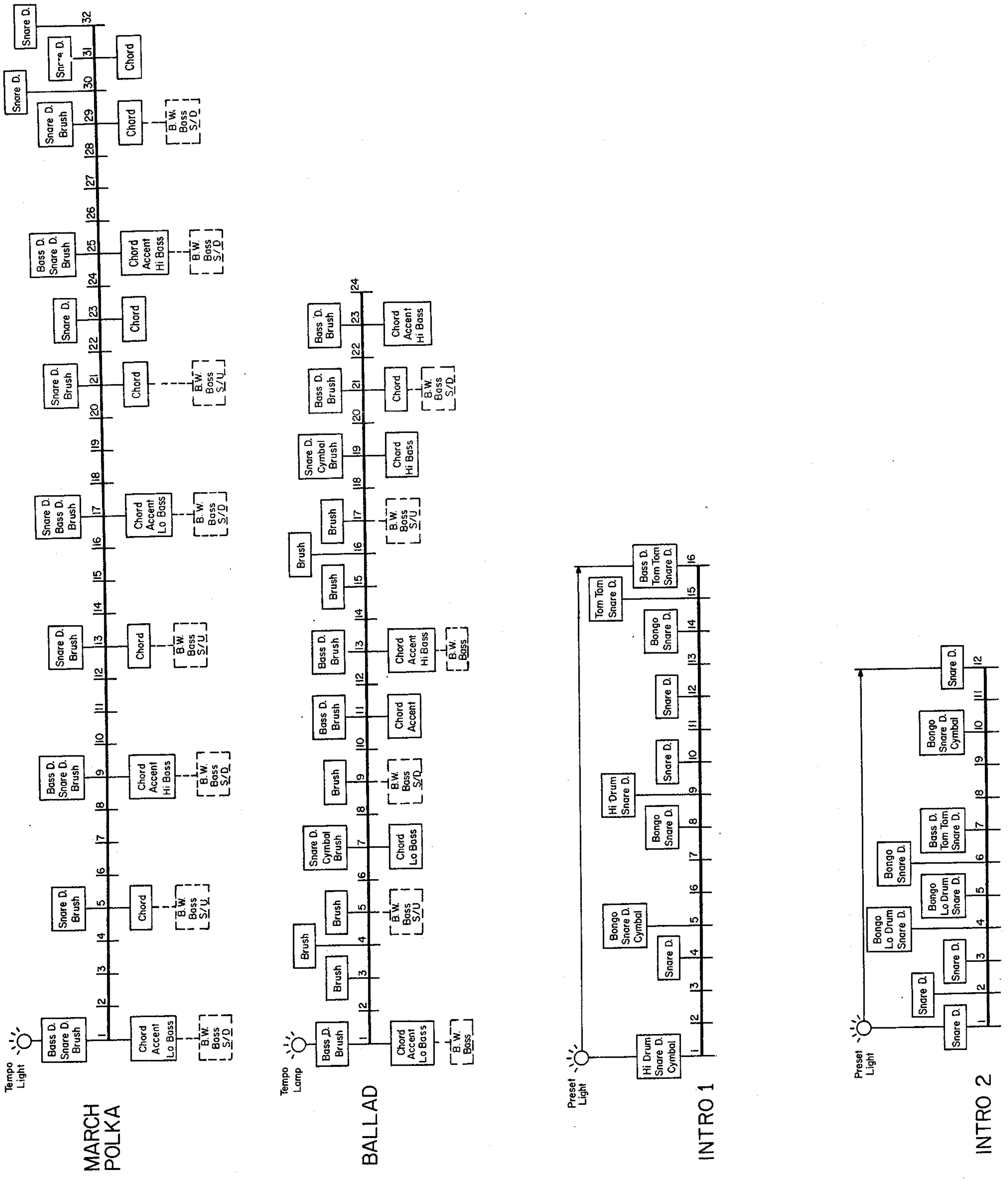


ROCK I
ROCK II
ROCK III
LATIN ROCK
Tempo Lamp
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
Bass D.
Snare D.
Cymbal
Brush
Lo Drum
Hi Drum
Tom Tom
Bongo
Blocks
Clave
Chord
Accent
Lo Bass
Hi Bass
B.W. Bass S/D
B.W. Bass S/U

RHYTHM PATTERNS DIAGRAM


RHUMBA
Tempo Light
1 Bass D. Tom Tom Clave Brush Hi Drum
Lo Bass
B.W. Bass S/D
3 Lo Drum Brush
Chord Accent
4 Brush
5 Lo Drum Brush
B.W. Bass S/U
7 Clave Brush Lo Drum
Chord
9 Bass D. Brush Hi Drum
Hi Bass
B.W. Bass S/D
11 Brush Lo Drum
Chord
13 Bass D. Bongo Clave Brush
Hi Bass
B.W. Bass S/U
15 Brush Lo Drum
Chord
17 Bass D. Tom Tom Brush Hi Drum
Lo Bass
B.W. Bass S/D
19 Lo Drum Brush
Chord Accent
20 Brush
21 Lo Drum Clave Brush
B.W. Bass S/U
23 Lo Drum Brush
Chord
25 Bass D. Clave Brush Hi Drum
Hi Bass
B.W. Bass S/D
27 Brush Lo Drum
Chord
29 Bass D. Bongo Brush
Hi Bass
B.W. Bass S/U
31 Bongo Brush Lo Drum
Chord
32
SAMBA
Tempo Light
1 Bass D. Bongo Snare D. Cymbal Brush
Chord Lo Bass
B.W. Bass S/D
3 Brush
5 Snare D. Brush
Chord
B.W. Bass S/U
7 Bongo Cymbal Brush
9 Bass D. Tom Tom Cymbal Brush Hi Drum Lo Drum
Chord Accent Hi Bass
B.W. Bass S/D
11 Brush
Chord
13 Brush
B.W. Bass S/U
15 Snare D. Cymbal Brush
Chord Accent
17 Bass D. Bongo Cymbal Brush
Lo Bass
B.W. Bass S/D
19 Bongo Snare D. Brush
Chord
21 Brush
B.W. Bass S/U
23 Bongo Snare D. Cymbal Brush
Chord Accent
25 Bass D. Tom Tom Cymbal Brush
Hi Bass
B.W. Bass S/D
27 Cymbal Brush Lo Drum Hi Drum
Chord
29 Snare D. Brush
Chord
B.W. Bass S/U
31 Cymbal Brush
32
BOSSA NOVA
Tempo Light
1 Bass D. Blocks Brush Hi Drum
Chord Lo Bass
B.W. Bass S/D
3 Brush
5 Cymbal Brush
Chord Accent
B.W. Bass S/U
7 Blocks Brush Hi Drum
9 Bass D. Brush
Hi-Bass
B.W. Bass S/D
11 Brush
Chord
13 Blocks Cymbal Brush Hi Drum
B.W. Bass S/U
15 Bass D. Brush
Chord Accent Hi Bass
17 Bass D. Brush
Lo Bass
B.W. Bass S/D
19 Brush
Chord Accent
21 Brush Blocks Cymbal Hi Drum
B.W. Bass S/U
23 Brush
Chord
25 Bass D. Brush
Hi Bass
B.W. Bass S/D
27 Blocks Brush Hi Drum
Chord
29 Cymbal Brush
Chord
B.W. Bass S/U
31 Bass D. Brush
Hi Bass
32
METRONOME
Tempo Light
1 Clave
9 Clave
13 Clave
21 Clave
24

RHYTHM PATTERNS DIAGRAM


MARCH POLKA
Tempo Light
Bass D. Snare D. Brush
Chord Accent Lo Bass
B.W. Bass S/D
Snare D. Brush
Chord
B.W. Bass S/U
Bass D. Snare D. Brush
Chord Accent Hi Bass
B.W. Bass S/D
Snare D. Brush
Chord
B.W. Bass S/U
Snare D. Bass D. Brush
Chord Accent Lo Bass
B.W. Bass S/D
Snare D. Brush
Chord
B.W. Bass S/U
Snare D.
Chord
Bass D. Snare D. Brush
Chord Accent Hi Bass
B.W. Bass S/D
Snare D. Brush
Chord
B.W. Bass S/D
Snare D.
Snare D.
Chord
Snare D.
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
BALLAD
Tempo Lamp
Bass D. Brush
Chord Accent Lo Bass
B.W. Bass
Brush
Brush
Brush
B.W. Bass S/U
Snare D. Cymbal Brush
Chord Lo Bass
Brush
B.W. Bass S/D
Bass D. Brush
Chord Accent
Bass D. Brush
Chord Accent Hi Bass
B.W. Bass
Brush
Brush
Brush
B.W. Bass S/U
Snare D. Cymbal Brush
Chord Hi Bass
Bass D. Brush
Chord
B.W. Bass S/D
Bass D. Brush
Chord Accent Hi Bass
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
INTRO 1
Preset Light
Hi Drum Snare D. Cymbal
Snare D.
Bongo Snare D. Cymbal
Bongo Snare D.
Hi Drum Snare D.
Snare D.
Snare D.
Bongo Snare D.
Tom Tom Snare D.
Bass D. Tom Tom Snare D.
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
INTRO 2
Preset Light
Snare D.
Snare D.
Snare D.
Bongo Lo Drum Snare D.
Bongo Lo Drum Snare D.
Bongo Snare D.
Bass D. Tom Tom Snare D.
Bongo Snare D. Cymbal
Snare D.
1 2 3 4 5 6 7 8 9 10 11 12

PARTS INFORMATION

STANDARD PARTS

Replacements for all standard electronic parts and hardware may be purchased directly from local suppliers generally in less time than would be required to obtain them from the factory.

SPECIAL PARTS

In addition to the standard replacement parts, special electronic and mechanical parts are also used. These parts are manufactured by and to the specifications of the factory. Order these parts directly from the factory since they would be difficult or impossible to obtain from other sources.

PARTS ORDERING INFORMATION

When ordering parts be sure to include the following information:

1. Model and Serial Number
2. Part Number
3. A description of the part
4. Specify how you want the part shipped.

Most special electronic parts and mechanical parts will have a part number stamped on them. In the event that the part number is missing, or you are unable to read the part number, a complete description of the part and where it is used will allow the factory to fill your parts order. When parts are ordered in the proper manner the factory is able to fill your orders promptly—delays that might result are avoided.

ADDRESS PARTS ORDERS TO:

LOWREY ELECTRONICS PARTS DEPARTMENT
4400 W. 45th Street
Chicago, Illinois 60632

IMPORTANT

IN ANY CORRESPONDENCE CONCERNING THIS INSTRUMENT ALWAYS INCLUDE MODEL AND SERIAL NUMBERS

PARTS LIST

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THE PARTS LIST CONTAINS THE FOLLOWING INFORMATION:

1. Name of Part
2. Value, Tolerance and Code (When Important)
3. Brief description
4. Where the part is found (assembly, printed circuit board, etc.)
5. Schematic Reference Number
6. PART NUMBER — USE IT!

This parts list includes all standard stock replacement parts. No attempt has been made to include every nut, bolt and screw. If the necessity for a non-listed part arises, please write describing the parts location and function as well as model and serial number of the unit.

PARTS LIST

Part	Description	Schematic Reference	Part Number
AMPLIFIER/POWER SUPPLY/EXPRESSION PEDAL & CROSSOVER ASSEMBLY			
Actuator	Arm		967-026076
Assembly	Glide Switch		997-026575
Assembly	Control Arm		997-026151
Assembly	Power Supply		997-027083
Assembly	Pedal & Glide Switch		997-026150
Bulb	GE1819		939-003190
Capacitor	Electrolytic 500 Dual 40V		945-024505
Capacitor	Electrolytic 2500 uf Dual 25V NP		945-026659
Capacitor	Electrolytic 3500-2500 45V 3000 20V		945-026649
Capacitor	Electrolytic 7500 45V		945-026652
Capacitor	Electrolytic 15 uf 6V		945-008895-079
Capacitor	Electrolytic 15 uf 25V		945-008895-002
Capacitor	Electrolytic 1 uf 20V		945-008895-011
Capacitor	Electrolytic 1 uf 35V NP		945-008895-015
Capacitor	Electrolytic 2 uf 50V		945-026065
Capacitor	Polystyrene .022 uf 10% 50V		946-026037-223
Capacitor	Polystyrene 1 mfd 20% 50V		946-026344-105
Capacitor	Crossover 60 uf 25V		945-026788
Capacitor	Crossover 200 uf 25V		945-025580
Capacitor	Crossover 50 uf 35V		945-008719-001
Clip	Fuse		976-026063
Coil	Crossover 5 mh	L28	956-026787
Coil	Crossover 3.7 mh	L27	956-024553
Coil	Crossover 6.3 mh	L29	956-026066
Cord	Power		989-08717
Diffuser	White		922-015938-001
Diode	15 amp Bridge Rectifier	D935	919-025522
Diode	4-Junction	D926	919-026053
Diode	1 amp 200V	D928, D934, D936-943	919-010623
Diode		D921-925, D927	919-024769
Diode	6 amps Bridge Rectifier	D933	919-022736-003
Fuse	5 amp 125V		939-013304-004
IC	Dual Amp	IC255	991-025244
IC	+12V Regulator	IC263	992-024149-008
IC	+24V Regulator	IC261	992-024149-014
IC	+12V Regulator	IC264	992-024149-007
IC	+8V Regulator	IC260	992-024149-005
IC	+18V Regulator	IC262	992-024149-011
IC	–12V Regulator	IC266	992-026646-007
IC	–15V Regulator	IC265	992-026646-010
Mat	Glide Switch		959-009208-003
Mat	Glide Switch		959-009208-004
Mat	Swell Pedal		959-022953
Pedal	Expression		964-022202
Photocell	Leslie Tremolo	P8	948-026647
Photocell	Expression Pedal	P5	948-018479
Potentiometer	500K Minimum Volume Adjustment	VR64	925-024590
Potentiometer	25K Maximum Volume Adjustment	VR63	925-021442-014
Potentiometer	250 Ohm Voltage Adjustment	VR67	925-004349-012
Resistor	4700 5% 1W		851-351472
Resistor			924-027382

PARTS LIST

AMPLIFIER/POWER SUPPLY/EXPRESSION PEDAL & CROSSOVER ASSEMBLY (Continued)

Part	Description	Schematic Reference	Part Number
Resistor	WW Fusible .5 Ohm 5W		924-026062-003
Resistor	WW Fusible 5 Ohm 5W		924-026062-002
Resistor	WW 25 Ohm 5.5W		924-026064-004
Resistor	WW 4 Ohm 10% 15W		924-006811-120
Resistor	WW 12 Ohm 10% 15W		924-006811-121
Resistor	WW 25 Ohm 10% 20W		924-006811-093
Resistor	WW 150 Ohm 10% 2W		924-010471-151
Socket	8-Pin		906-021448
Spring	Compression		975-011747-001
Spring	Glide Switch		975-022949
Switch	Glide		960-006340
Transformer	Power	T1	954-026709
Transistor	Power Darlington NPN Output	Q603	992-026039-002
Transistor	Power Darlington PNP Output	Q604	992-026040-002
Transistor	Relay Driver	Q605	991-013543
Transistor	Darlington Driver	Q595	991-016727
Transistor	Preamps	Q599, Q600	991-026054
Transistor	Driver	Q601	991-024184
Transistor	Regulator, Switcher	Q598, Q602	991-002232
Triac	Leslie Motor Control	TR1	992-026648

BENCH ASSEMBLY

Part	Description	Schematic Reference	Part Number
Bench	Walnut		978-026396

CHORD FUNCTION GENERATOR BOARD ASSEMBLY

Part	Description	Schematic Reference	Part Number
Capacitor	Electrolytic 1 uf 20V		945-008895-011
Capacitor	Electrolytic 25 uf 25V	C13	945-008895-008
Capacitor	Electrolytic 2x2 uf 30V Dual		945-024186
Capacitor	Polystyrene .1 uf 10% 50V		946-026037-104
Capacitor	Polystyrene .22 uf 10% 50V		946-026037-224
Capacitor	Polystyrene .01 uf 10% 50V		946-026037-103
Capacitor	Polystyrene .0068 uf 10% 50V		946-026037-682
Capacitor	Tantalum 5.6 uf 25V		946-021452-001
Capacitor	Tantalum .22 uf 20% 35V		946-012624-224
Capacitor	Tantalum 1.0 uf 20% 35V	All	946-012624-105
Diode		All	919-024769
IC	Quad Dual Input NAND Gate	IC188	991-024593
IC	Quad Dual Input AND Gate	IC186	991-025517
IC	Quad Dual Input NAND Gate	IC187	991-025515
IC	Quad Dual Input OR Gate	IC184, IC185	991-025516
IC	Dual D Flip-Flop	IC189, IC190	991-025225
IC	Chord Function Generator	IC183	991-026003
Network	23-Pin		949-024737
Potentiometer	50K 20% Chord Level Adjustment	VR40	925-004349-007
Socket	14-Pin		906-018905
Socket	40-Pin		906-022727
Transistor		Q339-341, Q345-348, Q354, Q356-360	991-002232
Transistor	Preamps	Q342-344	991-002298

PARTS LIST

Part	Description	Schematic Reference	Part Number
CHORUS MODULATOR BOARD ASSEMBLY			
Capacitor	Electrolytic 100 uf 10V		945-008895-020
Capacitor	Electrolytic 500 uf 18V	C6	945-008895-080
Capacitor	Electrolytic 1 uf 20V		945-008895-011
Capacitor	Electrolytic 2 uf 20V NP		945-008895-032
Capacitor	Electrolytic 6 uf 20V		945-008895-007
Capacitor	Electrolytic 20 mfd 25V		945-008895-030
Capacitor	Electrolytic 100 uf 25V	C1-C4	945-008895-045
Capacitor	Electrolytic 200 uf 25V	C7	945-008895
Capacitor	Electrolytic 1 uf 35V NP		945-008895-015
Capacitor	Polystyrene .0047 uf 10% 50V		946-026037-472
Capacitor	Polystyrene .0022 uf 10% 50V		946-026037-222
Capacitor	Polystyrene .0015 uf 10% 50V		946-026037-152
Capacitor	Polystyrene .001 uf 10% 50V		946-026037-102
Capacitor	Polystyrene .01 uf 10% 50V		946-026037-103
Capacitor	Polystyrene .082 uf 10% 50V		946-026037-823
Capacitor	Polystyrene .1 uf 10% 50V		946-026037-104
Capacitor	Polystyrene .12 uf 10% 50V		946-026037-124
Capacitor	Polystyrene .22 uf 10% 50V		946-026037-224
Capacitor	Polystyrene .47 uf 10% 50V		946-026037-474
Capacitor	Tantalum 5.6 uf 25V		946-021452-001
Diode		D565-567	919-024769
IC	Bucket Brigade	IC169, IC171, IC173	991-020077-001
IC	Volume Regulator	IC253, IC254	991-021444-001
IC	Voltage Controlled Oscillator	IC168, IC170, IC172	991-024543
Network	8-Pin		949-020068
Potentiometer	250K 20% Clock 1 Speed Adjustment	VR25	925-004349-002
Potentiometer	500K 20% Clock 2 Speed Adjustment	VR24	925-004349-008
Potentiometer	2500 Ohm 20% Phase 1,2,3 Level Adjustment	VR26, VR27, VR28	925-004349-011
Socket	6-Pin		906-021448-001
Socket	8-Pin		906-021448
Transistor		Q297, 298, 316, 324, 332	991-002298
Transistor	Oscillator	Q300-307, 310, 318, 326	991-008393
Transistor		Q311-313, 319-321, 327-329	991-010462
Transistor	Darlington	All others	991-013543
Transistor	Clock 1 & 2	Q299, Q308	991-015316
CONSOLE ASSEMBLY			
Back	Walnut		972-026612
Capacitor	Electrolytic 3 uf 20V NP		945-008895-092
Jack	Auxiliary		906-006104
Key Cap (1)	Plastic(Black)		
Key Cap (2)	Plastic (White)		
Key Cap (3)	Complete (Black or White)		

(1) All are identical.
(2) Include Key Letter designation. (Example: A or F, etc.)
(3) Available on special order only. Include Key Letter designation and Key location. Replacement keys will require special hand-fitting due to the hand-built construction of keyboards.

PARTS LIST

Part	Description	Schematic Reference	Part Number
CONSOLE ASSEMBLY (Continued)			
Reverb	Spring Unit		984-017447
Speaker	12-inch, 4 Ohm Bass Main & Leslie		985-026627
Speaker	3-inch, 4 Ohm Tweeter		985-026644
Speaker	6x9-inch, 8 Ohm Phase 2 & 3		985-009960-002
Speaker	8-inch, 8 Ohm Main		985-003185-003
DC CONTROL BOARD ASSEMBLY			
Capacitor	Electrolytic 1 uf 25V NP		945-008895-041
Capacitor	Electrolytic 1 uf 20V		945-008895-011
Capacitor	Polystyrene .01 uf 10% 50V		946-026037-103
Capacitor	Polystyrene .1 uf 10% 50V		946-026037-104
Capacitor	Tantalum 5.6 uf 25V		946-021452-001
Capacitor	Tantalum 2.2 uf 35V		946-012624-225
Capacitor	Tantalum 1.0 uf 20% 35V		946-012624-105
Diode	Zener 10V	Z5	919-017406-057
Diode		All others	919-024769
Diode	Triple	D41	919-010454-001
IC	Dual D Flip-Flop	IC42	991-025225
IC	Quad Dual Input NAND Gate	IC1, IC41	991-024593
IC	Comparator	IC19	991-024103
IC	Quad Dual Input NOR Gate	IC18	991-025536
IC	Noise Generator	IC204	991-024108
Potentiometer	1 M 20% Rest Adjustments	VR7, VR9	925-004349-004
Potentiometer	100K 20% Vibrato Speed Adjustment	VR1	925-004349-010
Socket	8-Pin		906-021448
Socket	14-Pin		906-018905
Transistor	Sustain Length Regulator	Q18	991-020425-001
Transistor		Q400-409	991-026315
Transistor		All others	991-010098
Transistor	Switcher	Q106	991-002298
Transistor		Q1,6,7,13,20,22-28,85, Q107,108,279,280,282, Q284	991-002232
Transistor		Q3, Q14, Q16	991-008393
Transistor		Q4, Q21, Q29, Q30	991-016727
Transistor	Switcher	Q2	991-013544
FLUTE/PERCUSSION DECODER BOARD ASSEMBLY			
Capacitor	Electrolytic 10 uf 45V		945-008895-085
Capacitor	Electrolytic 25 uf 25V	C24	945-008895-008
Diode	Zener 10V	Z7	919-017406-057
Diode	Zener 3.9V	Z1	919-017406-069
Diode		D530-532, D538-540, D548	919-024769
IC	Decoder	IC146-154	991-022793
Network	15M 18-Pin		949-026602
Network	3.3M 18-Pin		949-026666
Network	68K 18-Pin		949-027483
Socket	40-Pin		906-022727

PARTS LIST

FLUTE/PERCUSSION ENCODER BOARD ASSEMBLY

Part	Description	Schematic Reference	Part Number
Diode	Zener 16V	Z6	919-017406-008
Diode		D517-529	919-024769-050
IC	Dual 4-Stage Static Shift Register	IC84	991-026609
IC	18-Stage Static Shift Register	IC85,90,99,107,116,124, IC133, IC141	991-026603
IC	Quad Dual Input AND Gate	IC86,87,91,100,108,134, IC137	991-025517
IC	Quad Dual Input OR Gate	IC89,122,125,138,142	991-025516
IC	4-Wide 2-Input AND/OR/Invert	IC92,96-98,101,104-106, IC109,117,126,129,131, IC135,138,143	991-026614
IC	Triple 3-Input NAND Gate	IC102,115,123,132	991-026605
IC	4 to 16 Line Decoder	IC113	991-026616
IC	Dual Up Counter	IC114	991-026006
IC	Decode Counter Divider	IC120	991-026615
IC	Dual 2-Wide 2-Input AND/OR/Invert	IC130	991-026613
IC	64-Bit Data Shift Register	IC136	991-026608
IC	Triple 3-Input OR Gate	IC140	991-026606
IC	Quad Dual Input NAND Gate	IC88,94,95,103,110,111	991-024593
IC	Dual D Flip-Flop	IC93, IC112	991-025225
IC	Hex D Flip-Flop	IC118,119,127,128	991-026607
IC	Hex Inverter	IC121, 139	991-024594
Network	22K, 13-Pin		949-025521-001
Network	100K, 13-Pin		949-025521-002
Socket	14-Pin		906-018905
Socket	16-Pin		906-018905-001
Socket	24-Pin		906-018905-002

FLUTE/PERCUSSION FILTER BOARD ASSEMBLY

Part	Description	Schematic Reference	Part Number
Capacitor	Electrolytic 1 uf 35V NP		945-008895-015
Capacitor	Electrolytic 4 uf 35V NP		945-008895-016
Capacitor	Electrolytic 50 uf 15V		945-008895-005
Capacitor	Electrolytic 25 uf 25V	C11	945-008895-008
Capacitor	Electrolytic 100 uf 10V		945-008895-020
Capacitor	Electrolytic 10 mfd 25V		945-008895-031
Capacitor	Electrolytic 100 uf 15V	C29, C38	945-008895-044
Capacitor	Electrolytic 100 uf 20V	C30, 39	945-020064
Capacitor	Electrolytic 1 uf 20V		945-008895-011
Capacitor	Polystyrene .01 uf 10% 50V		946-026037-103
Capacitor	Polystyrene .22 uf 10% 50V		946-026037-224
Capacitor	Polystyrene .1 uf 10% 50V		946-026037-104
Capacitor	Tantalum 5.6 uf 25V		946-021452-001
Diode		D561,562,570-575	919-024769
IC	Quad Op-Amp	IC162-165, 176-180	991-025267
IC	Bucket Brigade	IC181	991-025584
IC	Op-Amp	IC252	991-021444-001
Network	68K, 10-Pin		949-024537
Potentiometer	10K 20% Bias Adjustment	VR30	925-004349-003
Potentiometer	1M 20% Speed Adjustment	VR31	925-004349-004
Socket	8-Pin		906-021448
Socket	14-Pin		906-018905

PARTS LIST

Part	Description	Schematic Reference	Part Number
FLUTE/PERCUSSION FILTER BOARD ASSEMBLY (Continued)			
Transistor	Voltage Controlled Oscillator	Q335, 336	991-010098-003
Transistor	Chorus Amplitude Switcher	Q292	991-002232
Transistor	Leslie Output Amp	Q597	991-002298
Transistor	Flute Chorus Switcher	Q293	991-022774
FLUTE & GENERAL PRESET BOARD ASSEMBLY			
Capacitor	Electrolytic 6 uf 20V		945-008895-007
Capacitor	Electrolytic 25 uf 25V	C20	945-008895-008
Capacitor	Polystyrene .068 uf 10% 50V		946-026037-683
Capacitor	Polystyrene .12 uf 10% 50V		946-026037-124
Diode		All	919-024769
IC	Dual D Flip-Flop	IC69-71, 75, 78-81	991-025225
IC	Quad Dual Input NAND Gate	IC74	991-024593
IC	Hex Schmitt Trigger	IC67, 68, 77	991-025576
IC	Quad Dual Input AND Gate	IC72, 76, 82	991-026604
Resistor	WW 33 10% 2W		924-010471-330
Socket	14-Pin		906-018905
Socket	18-Pin Preset Switches		906-026625
Switch	Flute & General Preset Modules		960-026626
Transistor		Q250,251,253,255,257, Q270, 271	991-010098
Transistor		All others	991-002232
Transistor		Q245, Q478	991-020426-001
GOLDEN HARP BOARD ASSEMBLY			
Diode		All	919-024769
IC	Up/Down Decoder	IC247	991-024595
IC	Dual D Flip-Flop	IC237	991-025225
IC	Quad Dual Input NAND Gate	IC239, 240	991-025515
IC	Quad Dual Input AND Gate	IC241, IC242	991-025517
IC	Dual J-K Flip-Flop	IC243	991-026022
IC	Octave Count Decoder	IC245	991-026023
IC	Counters	IC244, IC246	991-026024
IC	Quad Dual Input NOR Gate	IC238	991-026025
Socket	14-Pin		906-018905
Socket	16-Pin		906-018905-001
Socket	24-Pin		906-018905-002
Transistor		Q579-581, 584-589	991-002232
Transistor	Driver, Enable	Q582, 583	991-008393
INSTRUMENTATION BOARD ASSEMBLY			
Capacitor	Electrolytic 50 uf 15V	C15	945-008895-005
Capacitor	Electrolytic 15 uf 20V		945-008895-010
Capacitor	Electrolytic 1 uf 20V		945-008895-011
Capacitor	Electrolytic 8 uf 35V NP		945-008895-014
Capacitor	Electrolytic 2 uf 20V NP		945-008895-032
Capacitor	Electrolytic 1 uf 25V NP		945-008895-041
Capacitor	Electrolytic 100 uf 15V	C22	945-008895-044
Capacitor	Electrolytic 350 uf 25V	C14	945-008895-084

PARTS LIST

Part	Description	Schematic Reference	Part Number
INSTRUMENTATION BOARD ASSEMBLY (Continued)			
Coil	Toroid 27 MH	L15-18	952-016273
Coil	Toroid 5 H	L10	952-021447-001
Coil	Toroid 10 H	L8, L11, L12	952-021447-002
Coil	Toroid 1.5 H	L9	952-021447-003
Coil	Toroid 500 MH	L13, L14	952-021447-008
Diode		D734-736	919-010873
Diode		D643-646, D709, D724-733, D737-740	919-024769
Network	Noise Voicing		949-022991
Potentiometer	50K 20% Snare Noise, Cymbal, Brush Adjust	VR45, VR47, VR48	925-004349-007
Transistor		Q410-417, Q420, Q427, Q431, Q432	991-002298
Transistor		All others	991-008393
Transistor		Q377	991-010098
Transistor		Q421	991-013544-001
Transistor		Q419	991-016727
LESLIE TREMOLO UNIT			
Assembly	Leslie Unit Complete		984-026339
Assembly	Motor		138756
Assembly	Rotor and Shaft		138761
Bearing	Plastic		137264
Belt	Drive		138675
Grommet	Neoprene		137255
Speaker	10-inch, 8-ohm		017202
Support	Rotor, Back		137256
Support	Rotor, Hub		137533
Support	Rotor, Steel Rod		138775
LOWER KEYSWITCH ASSEMBLY			
Actuator	Keyswitch		964-024116
Clip	Spring		976-009364-002
Coil	70 mh	L3, L4, L22	956-018877
Diode	Scan Keyswitch		919-024769
Spring	Contact		917-015558
Spring	Pulldown		975-007085
LOWER R/S KEYING CONTROL & DIODE READOUT BOARD ASSEMBLY			
Capacitor	Electrolytic 2x2 uf 30V Dual		945-024186
Capacitor	Tantalum 2.2 uf 35V		946-012624-225
Diode		All	919-024769
Network	68K, 14-Pin		949-022779
MAGIC GENIE 4-FOOT TOS, AOC & OSCILLATOR BOARD ASSEMBLY			
Capacitor	Electrolytic 10 uf 20V		945-008895-009
Capacitor	Electrolytic 25 uf 15V	C18	945-008895-029
Capacitor	Electrolytic 10 uf 15V		945-019366-003

PARTS LIST

MAGIC GENIE 4-FOOT TOS, AOC & OSCILLATOR BOARD ASSEMBLY (Continued)

Part	Description	Schematic Reference	Part Number
Capacitor	Polystyrene 200 pf 5% 63V		946-024767-005
Capacitor	Tantalum 10 uf 20% 35V		946-021452-005
Coil	Chord Tuning Adjustment	L6	952-018874-006
Diode		D613	919-010873
Diode		D612	919-024117
Diode		All others	919-024769
IC	4-Foot TOS	IC195	991-018813-002
IC	4-Foot TOS	IC196	991-018813-001
IC	Dual D Flip-Flop	IC191-193	991-025225
IC	Decoder	IC194	991-022793
Network	22K, 13-Pin		949-025521-001
Network	100K, 13-Pin		949-025521-002
Network	470K, 13-Pin		949-025521-003
Resistor	WW 220 Ohm 10% 2W		924-010471-221
Socket	14-Pin		906-018905
Socket	40-Pin		906-022727
Transistor		Q349, 350, 352, 355	991-002232
Transistor		Q351	991-016727
Transistor		Q353	991-025535

ORCHESTRAL SYMPHONIZER KEYER BOARD ASSEMBLY

Part	Description	Schematic Reference	Part Number
Diode		All	919-024769
Transistor	Pulse Keyer	Q512, Q515	991-008393

ORCHESTRAL SYMPHONIZER KEYING CONTROL BOARD 1 & 2

Part	Description	Schematic Reference	Part Number
Capacitor	Polystyrene .22 uf 10% 50V		946-026037-224
Capacitor	Polystyrene .33 uf 10% 50V		946-026037-334
Capacitor	Polystyrene .27 uf 10% 50V		946-026037-274
Diode		D824, 825, 834, 835	919-004799
Diode		All others	919-024769
Transistor	8-, 16-Foot Switcher	Q511, 513	991-010098
Transistor	Orchestral Symphonizer, Orchestral Symphonizer Pedal Keyer	Q510, 514	991-026617

ORCHESTRAL SYMPHONIZER LATCH BOARD ASSEMBLY

Part	Description	Schematic Reference	Part Number
Capacitor	Electrolytic 2 uf 50V		945-008895-065
Capacitor	Electrolytic 6 uf 20V		945-008895-007
Capacitor	Electrolytic 25 uf 15V	C26	945-008895-029
Capacitor	Polystyrene .033 uf 10% 50V		946-026037-333
Capacitor	Polystyrene .1 uf 10% 50V		946-026037-104
Diode		All	919-024769
IC	Quad Dual Input NOR Gate	IC212	991-025536
IC	Dual D Flip-Flop	IC209, 210	991-025225
IC	Dual Up Counter	IC213	991-026006
IC	Quad Dual Input Exclusive OR Gate	IC211	991-026005
IC	8-Bit Priority Encoder	IC207, 208	991-025599
IC	Quad Dual Input NAND Gate	IC214	991-024593
IC	Up/Down Decoder	IC215	991-024595

PARTS LIST

ORCHESTRAL SYMPHONIZER LATCH BOARD ASSEMBLY (Continued)

Part	Description	Schematic Reference	Part Number
Socket	14-Pin		906-018905
Socket	16-Pin		906-018905-001
Socket	24-Pin		906-018905-002
Transistor		Q483, 486, 493, 501, 506	991-002232
Transistor		Q436-451,480,482,484, Q505	991-010098-002
Transistor		Q485	991-016727
Transistor		Q492	991-015663
Transistor		Q489, 491	991-015614
Transistor		Q479, 481, 497.	991-008393
Transistor		Q488, 490, 494-496, 498-500, 502-504	991-013544

ORCHESTRAL SYMPHONIZER QUALITY CONTROL BOARD ASSEMBLY

Part	Description	Schematic Reference	Part Number
Capacitor	Electrolytic 50 uf 15V		945-008895-005
Capacitor	Electrolytic 25 uf 25V	C36	945-008895-008
Capacitor	Electrolytic 10 uf 20V		945-008895-009
Capacitor	Electrolytic 1 uf 35V NP		945-008895-015
Capacitor	Electrolytic 4 uf 35V NP		945-008895-016
Capacitor	Electrolytic 100 uf 10V		945-008895-020
Capacitor	Electrolytic 25 uf 15V	C9	945-008895-029
Capacitor	Electrolytic 20 mfd 25V		945-008895-030
Capacitor	Electrolytic 100 uf 15V	C34, 42	945-008895-044
Capacitor	Electrolytic 500 uf 18V	C33, 41	945-008895-080
Capacitor	Electrolytic 2 uf 50V		945-008895-065
Capacitor	Electrolytic 10 uf 25V NP		945-008895-091
Capacitor	Polystyrene .1 uf 10% 50V		946-026037-104
Capacitor	Polystyrene .01 uf 10% 50V		946-026037-103
Capacitor	Polystyrene .001 uf 10% 50V		946-026037-102
Capacitor	Polystyrene .0015 uf 10% 50V		946-026037-152
Capacitor	Polystyrene .015 uf 10% 50V		946-026037-153
Capacitor	Polystyrene .012 uf 10% 50V		946-026037-123
Capacitor	Polystyrene .0012 uf 10% 50V		946-026037-122
Capacitor	Polystyrene .15 uf 10% 50V		946-026037-154
Capacitor	Polystyrene .018 uf 10% 50V		946-026037-183
Capacitor	Polystyrene .0022 uf 10% 50V		946-026037-222
Capacitor	Polystyrene .022 uf 10% 50V		946-026037-223
Capacitor	Polystyrene .22 uf 10% 50V		946-026037-224
Capacitor	Polystyrene .27 uf 10% 50V		946-026037-274
Capacitor	Polystyrene .027 uf 10% 50V		946-026037-273
Capacitor	Polystyrene .0033 uf 10% 50V		946-026037-332
Capacitor	Polystyrene .033 uf 10% 50V		946-026037-333
Capacitor	Polystyrene .0039 uf 10% 50V		946-026037-392
Capacitor	Polystyrene .0047 uf 10% 50V		946-026037-472
Capacitor	Polystyrene .047 uf 10% 50V		946-026037-473
Capacitor	Polystyrene .039 uf 10% 50V		946-026037-393
Capacitor	Polystyrene .0056 uf 10% 50V		946-026037-562
Capacitor	Polystyrene .0068 uf 10% 50V		946-026037-682
Capacitor	Polystyrene .068 uf 10% 50V		946-026037-683
Capacitor	Polystyrene .0082 uf 10% 50V		946-026037-822
Capacitor	Tantalum 2.2 uf 35V		946-012624-225

PARTS LIST

ORCHESTRAL SYMPHONIZER QUALITY CONTROL BOARD ASSEMBLY (Continued)

Part	Description	Schematic Reference	Part Number
Diode		All others	919-024769
Diode		D775-784	919-004799
IC	Bucket Brigade	IC235	991-025584
IC	Dual Op-Amp	IC226	991-025244
IC	Quad Op-Amp	IC228-231	991-021444-001
IC	Quad Op-Amp	IC219-225, 227, 234	991-025267
IC	Quad Op-Amp	IC218	991-024103
Potentiometer	10K 20% Bias Adjustment	VR53	925-004349-003
Potentiometer	1 M 20% Speed Adjustment	VR54	925-004349-004
Socket	IC 8-Pin		906-021448
Socket	14-Pin		906-018905
Transistor		Q545, 546, 547	991-010098
Transistor		Q548, 549	991-010098-003
Transistor			991-013544
Transistor		Q531, 532, 540	991-016727
Transistor		Q539	991-013543
Transistor		Q525, 526	991-002232
Transistor		Q520,524,527-530,533-538	991-022774
Transistor		Q458	991-015663

PANTOMIME DECODER BOARD ASSEMBLY

Part	Description	Schematic Reference	Part Number
Capacitor	Electrolytic 25 uf 25V		945-008895-008
Diode		D550-552, 554, 555	919-024769
IC	Decoder	IC56-59	991-022793
Socket	40-Pin		906-022727
Transistor	Strobe Disable	Q287, 288	991-010098

PEDAL SYMPHONIZER QC & CONTROL BOARD ASSEMBLY

Part	Description	Schematic Reference	Part Number
Capacitor	Electrolytic 25 uf 5V		945-008895-051
Capacitor	Electrolytic 25 uf 25V	C10	945-008895-008
Capacitor	Electrolytic 1 uf 20V		945-008895-011
Capacitor	Electrolytic 1 uf 35V NP		945-008895-015
Capacitor	Electrolytic 4 uf 35V NP		945-008895-016
Capacitor	Electrolytic 100 uf 10V		945-008895-020
Capacitor	Electrolytic 25 uf 15V	C28, 37	945-008895-029
Capacitor	Electrolytic 10 uf 45V		945-008895-085
Capacitor	Polystyrene .1 uf 10% 50V		946-026037-104
Capacitor	Polystyrene .01 uf 10% 50V		946-026037-103
Capacitor	Polystyrene .0012 uf 10% 50V		946-026037-122
Capacitor	Polystyrene .015 uf 10% 50V		946-026037-153
Capacitor	Polystyrene .22 uf 10% 50V		946-026037-224
Capacitor	Polystyrene .022 uf 10% 50V		946-026037-223
Capacitor	Polystyrene .0027 uf 10% 50V		946-026037-272
Capacitor	Polystyrene .027 uf 10% 50V		946-026037-273
Capacitor	Polystyrene .033 uf 10% 50V		946-026037-333
Capacitor	Polystyrene .0033 uf 10% 50V		946-026037-332
Capacitor	Polystyrene .0039 uf 10% 50V		946-026037-392
Capacitor	Polystyrene .039 uf 10% 50V		946-026037-393

PARTS LIST

PEDAL SYMPHONIZER QC & CONTROL BOARD ASSEMBLY (Continued)

Part	Description	Schematic Reference	Part Number
Capacitor	Polystyrene .047 uf 10% 50V		946-026037-473
Capacitor	Polystyrene .0068 uf 10% 50V		946-026037-682
Capacitor	Polystyrene .068 uf 10% 50V		946-026037-683
Capacitor	Polystyrene .33 uf 10% 50V		946-026037-334
Capacitor	Polystyrene .0047 uf 10% 50V		946-026037-472
Capacitor	Polystyrene .0056 uf 10% 50V		946-026037-562
Capacitor	Tantalum 5.6 uf 25V		946-021452-001
Diode		All others	919-024769
Diode		D205, 211	919-004799
IC	Op-Amp	IC64, 65	991-021444-001
IC	Op-Amp	IC61-63	991-025267
IC	6-Stage Divider	IC52	991-021331-002
IC	Hex Schmitt Trigger	IC54, 57	991-025576
IC	Dual D Flip-Flop	IC55, 56, 58, 59	991-025225
Network	68K, 10-Pin		949-024537
Socket	8-Pin		906-021448
Socket	14-Pin		906-018905
Transistor		Q151,183,184,188,189, 194,195	991-013544
Transistor		Q150, 152, 182, 187	991-015614
Transistor		Q145,147,154,167,169, 171,176,178,181,185,191, 226,227,231,232,236,237	991-010098
Transistor		Q215, 224	991-002298
Transistor		Q156, 159, 193	991-018238
Transistor		Q153, 198	991-026617
Transistor		Q204-206, 213,214,228-230,233-235, 240	991-022774
Transistor		Q179, 180, 237, 238	991-016727
Transistor		All others	991-002232
Transistor		Q155, 157, 160,164, 201, 202	991-008393

PERCUSSION KEYER BOARD ASSEMBLY

Part	Description	Schematic Reference	Part Number
Capacitor	Polystyrene .1 uf 10% 50V		946-026037-104
Capacitor	Polystyrene .15 uf 10% 50V		946-026037-154
Capacitor	Polystyrene .18 uf 10% 50V		946-026037-184
Capacitor	Polystyrene .22 uf 10% 50V		946-026037-224
Diode		D541-543, 546	919-024769
Diode		D544, 545, 547	919-004799
Transistor	Percussion Keyer	Q277	991-026315

REED STRING QUALITY CONTROL BOARD ASSEMBLY

Part	Description	Schematic Reference	Part Number
Capacitor	Electrolytic 50 uf 15V	C31, 40	945-008895-005
Capacitor	Electrolytic 1 uf 20V		945-008895-011
Capacitor	Electrolytic 1 uf 35V NP		945-008895-015
Capacitor	Electrolytic 100 uf 10V		945-008895-020
Capacitor	Electrolytic 100 uf 15V	C12	945-008895-044
Capacitor	Electrolytic 2 uf 50V		945-008895-065
Capacitor	Polystyrene .22 uf 10% 50V		946-026037-224

PARTS LIST

Part	Description	Schematic Reference	Part Number
REED STRING QUALITY CONTROL BOARD ASSEMBLY (Continued)			
Capacitor	Polystyrene .1 uf 10% 50V		946-026037-104
Capacitor	Polystyrene .18 uf 10% 50V		946-026037-184
Capacitor	Polystyrene .0039 uf 10% 50V		946-026037-392
Capacitor	Polystyrene .0047 uf 10% 50V		946-026037-472
Capacitor	Polystyrene .022 uf 10% 50V		946-026037-223
Capacitor	Polystyrene .0068 uf 10% 50V		946-026037-682
Capacitor	Polystyrene .068 uf 10% 50V		946-026037-683
Capacitor	Polystyrene .33 uf 10% 50V		946-026037-334
Capacitor	Polystyrene .047 uf 10% 50V		946-026037-473
Capacitor	Polystyrene .0022 uf 10% 50V		946-026037-222
Capacitor	Tantalum 5.6 uf 25V		946-021452-001
Diode		All	919-024769
IC	Quad Op-Amp	IC34, 37, 38, 50, 51	991-021444-001
IC	Dual Op-Amp	IC39	991-025244
IC	Quad Op-Amp	IC33, 35	991-025267
IC	Quad Op-Amp	IC36	991-024103
Potentiometer	50K 20% Genie Thump Adjustment	VR15	925-004349-007
Socket	14-Pin		906-018905
Socket	8-Pin		906-021448
Transistor		Q67	991-008393
Transistor		All others	991-022774
Transistor		Q77, 78	991-016727
Transistor		Q596	991-002298
RHYTHM CLOCK BOARD ASSEMBLY			
Capacitor	Electrolytic 1000 uf 15V	C21	945-008895-061
Capacitor	Polystyrene .1 uf 10% 50V		946-026037-104
Capacitor	Polystyrene .0047 uf 10% 50V		946-026037-472
Capacitor	Polystyrene .015 uf 10% 50V		946-026037-153
Capacitor	Polystyrene .068 uf 10% 50V		946-026037-683
Capacitor	Polystyrene .01 uf 10% 50V		946-026037-103
Capacitor	Polystyrene .27 uf 10% 50V		946-026037-274
Capacitor	Polystyrene .39 uf 10% 50V		946-026037-394
Capacitor	Polystyrene .47 uf 10% 50V		946-026037-474
Diode		All	919-024769
IC	ROM	IC201	991-022729
IC	Resetable Counter	IC200	991-018495
Socket	16-Pin		906-018905-001
Socket	40-Pin		906-022727
Transistor		All others	991-008393
Transistor		Q216,363,364,379-381, 384,386,387,390-392, 394-397	991-010098
Transistor		Q217, 368	991-016727
Transistor		Q365, 366	991-018493
Transistor		Q283	991-002232
SYMPHONIC STRING & DIAPASON QUALITY CONTROL BOARD ASSEMBLY			
Capacitor	Electrolytic 100 uf 15V	C32	945-008895-044
Capacitor	Electrolytic 25 uf 25V	C43	945-008895-008

PARTS LIST

Part	Description	Schematic Reference	Part Number
SYMPHONIC STRING & DIAPASON QUALITY CONTROL BOARD ASSEMBLY (Continued)			
Capacitor	Electrolytic 10 uf 20V		945-008895-009
Capacitor	Electrolytic 1 uf 20V		945-008895-011
Capacitor	Electrolytic 1 uf 35V NP		945-008895-015
Capacitor	Electrolytic 4 uf 35V NP		945-008895-016
Capacitor	Electrolytic 2 uf 20V NP		945-008895-032
Capacitor	Electrolytic 2 uf 20V NP		945-008895-090
Capacitor	Polystyrene .012 uf 10% 50V		946-026037-123
Capacitor	Polystyrene .001 uf 10% 50V		946-026037-102
Capacitor	Polystyrene .01 uf 10% 50V		946-026037-103
Capacitor	Polystyrene .1 uf 10% 50V		946-026037-104
Capacitor	Polystyrene .0015 uf 10% 50V		946-026037-152
Capacitor	Polystyrene .018 uf 10% 50V		946-026037-183
Capacitor	Polystyrene .15 uf 10% 50V		946-026037-154
Capacitor	Polystyrene .015 uf 10% 50V		946-026037-153
Capacitor	Polystyrene .0022 uf 10% 50V		946-026037-222
Capacitor	Polystyrene .022 uf 10% 50V		946-026037-223
Capacitor	Polystyrene .22 uf 10% 50V		946-026037-224
Capacitor	Polystyrene .027 uf 10% 50V		946-026037-273
Capacitor	Polystyrene .0033 uf 10% 50V		946-026037-332
Capacitor	Polystyrene .033 uf 10% 50V		946-026037-333
Capacitor	Polystyrene .039 uf 10% 50V		946-026037-393
Capacitor	Polystyrene .0047 uf 10% 50V		946-026037-472
Capacitor	Polystyrene .047 uf 10% 50V		946-026037-473
Capacitor	Polystyrene .0056 uf 10% 50V		946-026037-562
Capacitor	Polystyrene .056 uf 10% 50V		946-026037-563
Capacitor	Polystyrene .0068 uf 10% 50V		946-026037-682
Capacitor	Polystyrene .068 uf 10% 50V		946-026037-683
Capacitor	Polystyrene .0082 uf 10% 50V		946-026037-822
Capacitor	Polystyrene .082 uf 10% 50V		946-026037-823
Capacitor	Tantalum 5.6 uf 25V		946-021452-001
Diode		All	919-024769
IC	Dual Op-Amp	IC250	991-025244
IC	Quad Op-Amp	IC49	991-021444-001
IC	Quad Op-Amp	IC22-31, 44-48	991-025267
Network	68K 5% 10-Pin		949-024537
Photocell		P1, P3	948-022782
Socket	8-Pin		906-021448
Socket	14-Pin		906-018905
Transistor	FET Audio Switchers	All others	991-022774
Transistor	Preamp	Q107	991-018238
Transistor	Darlington Emitter Follower	Q100	991-016727
TAB PANEL ASSEMBLY			
Bulb	Preset Switches		939-018289
Bulb	Tab Panel Lights		939-026038-002
Guide	Slider		976-005170-001
Jack	Headphone		910-024526
Knob	Blue Variegated		915-026335-003
Knob	Gray Variegated		915-026335-006
Knob	Green Variegated		915-026335-005

PARTS LIST

Part	Description	Schematic Reference	Part Number
TAB PANEL ASSEMBLY (Continued)			
Knob	Red Variegated		915-026335-002
Knob	White Pearl		915-026335-001
Knob	Yellow Variegated		915-026335-004
Lens	White Lighted Pushbutton		922-018413-001
Lens	Red Lighted Pushbutton		922-018413-002
Lens	Blue Lighted Pushbutton		922-018413-003
Lens	Yellow Lighted Pushbutton		922-018413-004
Lens	Green Lighted Pushbutton		922-018413-005
Potentiometer	1 M Speed Control	VR43	925-021442-010
Potentiometer	1.5 M Repeat Speed	VR19	925-021442-011
Potentiometer	1K Orchestral Volume	VR51	925-021442-016
Potentiometer	5K Vibrato Depth	VR2	925-021442-008
Potentiometer	10K Flute & R/S Sustain, Reverb Length, Rhythm Balance	VR10, 21, 48, 62	925-021442-007
Potentiometer	10K Audio Upper & Lower String Volume, Genie Volume, Lower Flute Volume, Arpeggio Volume, Strum Volume	VR13, 16, 17, 22, 38, 39	925-021442-012
Potentiometer	100K Vibrato Speed, Wow Range	VR3, 8	925-021442-009
Potentiometer	100K Audio Rhythm Volume	VR49	925-021442-013
Potentiometer	500K Harp Speed	VR60	925-021442-015
Pushbutton	Black		915-024199-017
Pushbutton	Gray Variegated		915-024199-005
Pushbutton	Green Variegated		915-024199-006
Pushbutton	Red Variegated		915-024199-008
Pushbutton	White Pearl		915-024199-007
Pushbutton	Yellow Variegated		915-024199-009
Pusher	Medium		964-025555
Retainer	Lamp Socket		976-026087
Socket	Tab Panel Lamp		906-026045
Spring	Contact		917-005166-004
Spring	Toggle		975-025543
Switch	Lighted Pushbutton Power On/Off		960-026662-001
Switch	Lighted Pushbutton Orchestral Symphonic, Presets, Pedal & Percussion		960-018286
Switch	Pushbutton Golden Harp 6-Position		960-024525-001
Switch	Orchestral Symphonic 8/16		960-026057-001
Switch	Automatic Rhythm 17-Position		960-024525
Switch	Flute Preset 3 Module		960-026626
Switch	Bass Volume 4-Position		960-024525-002
Switch	Manual Rhythm 4-Position		960-024525-003
Tab	AOC		915-025544-005
Tab	Accordion		915-025544-010
Tab	Banjo		915-025544-014
Tab	Boogie Woogie Bass		915-025544-025
Tab	Cello 16		915-025544-023
Tab	Chord Hold		915-025544-031
Tab	Chorus Celeste		915-025544-081
Tab	Diapason 8		915-025544-065
Tab	Diaphone 16		915-025544-076
Tab	Electric Piano		915-025544-016
Tab	English Horn 8		915-025544-060

PARTS LIST

TAB PANEL ASSEMBLY (Continued)

Part	Description	Schematic Reference	Part Number
Tab	Flute Chorus		915-025544-072
Tab	Flute 1		915-025544-069
Tab	Flute 1-1/3		915-025544-068
Tab	Flute 1-3/5		915-025544-067
Tab	Flute 2		915-025544-034
Tab	Flute 2-2/3		915-025544-035
Tab	Flute 4		915-025544-036
Tab	Flute 5-1/3		915-025544-037
Tab	Flute 8		915-025544-038
Tab	Flute 16		915-025544-039
Tab	Genie Flute		915-025544-070
Tab	Genie Flute Accent		915-025544-078
Tab	Genie Guitar Bass		915-025544-050
Tab	Genie Plus Organ		915-025544-043
Tab	Genie String Bass		915-025544-051
Tab	Golden Harp		915-025544-077
Tab	Guitar		915-025544-045
Tab	Guitar Strum		915-025544-030
Tab	Harpsichord		915-025544-024
Tab	Harpsichord Arpeggio		915-025544-026
Tab	Hawaiian Guitar		915-025544-018
Tab	Kinura 8		915-025544-040
Tab	Leslie Tremolo		915-025544-074
Tab	Magic Genie Chords		915-025544-032
Tab	Octave 4		915-025544-071
Tab	Orchestral Clarinet		915-025544-011
Tab	Pedal 8		915-025544-055
Tab	Pedal 16		915-025544-056
Tab	Pedal Sustain		915-025544-057
Tab	Pedal Wow		915-025544-052
Tab	Percuss Full		915-025544-082
Tab	Percuss Long		915-025544-004
Tab	Piano		915-025544-017
Tab	Piano Arpeggio		915-025544-027
Tab	Piccolo		915-025544-009
Tab	Repeat		915-025544-061
Tab	Rhythm Start		915-025544-046
Tab	Rhythm Start Auto		915-025544-047
Tab	Strum Downbeat		915-025544-028
Tab	Sustain Lower Flute		915-025544-080
Tab	Sustain Upper		915-025544-063
Tab	Symphonic Wow		915-025544-007
Tab	Trombone 16		915-025544-042
Tab	Trumpet 16		915-025544-041
Tab	Ukulele		915-025544-044
Tab	Ukulele Strum		915-025544-029
Tab	Vibes		915-025544-020
Tab	Vibra Harp		915-025544-019
Tab	Vibrato		915-025544-006
Tab	Viola 8		915-025544-022
Tab	Violin		915-025544-008

PARTS LIST

TAB PANEL ASSEMBLY (Continued)

Part	Description	Schematic Reference	Part Number
Tab	Violina 4		915-025544-021
Tab	Vox Celeste 4		915-025544-079
Tab	Vox Humana 8		915-025544-066
Tab	Wow Attack Slow		915-025544-001

TONE GENERATOR BOARD ASSEMBLY

Part	Description	Schematic Reference	Part Number
Capacitor	Electrolytic 25 uf 25V	C8, 17	945-008895-008
Capacitor	Electrolytic 1 uf 35V NP		945-008895-015
Capacitor	Electrolytic 4 uf 35V NP		945-008895-016
Capacitor	Polystyrene .1 uf 10% 50V		946-026037-104
Capacitor	Polystyrene 150 pf 2-1/2% 33V		946-013181-151
Capacitor	Tantalum 1.0 uf 35V		946-021452-002
Capacitor	Tantalum 10 uf 15V	C16	946-021452-008
Capacitor	Tantalum 5.6 uf 25V	C35	946-021452-001
Coil	Tuning Adjustment 28 uh	L1	952-018874-002
Diode	Glide	D11	919-024117
Diode		All others	919-024769
IC	TOS	IC2	991-018813-001
IC	TOS	IC3	991-018813-002
IC	6-Stage Divider	IC4-15	991-025539-002
Network	100K, 22-Pin		949-024536
Resistor	WW 220 Ohm 10% 2W		924-010471-221
Socket	14-Pin		906-018905
Transistor	Switcher, Trigger	Q5, 114, 130	991-002232
Transistor	Keydown Detectors	All others	991-010098
Transistor	Trigger	Q113, 129	991-008393
Transistor	Collector Amp	Q128, 143	991-016727
Transistor	Master Oscillator, Buffers	Q8-10	991-025535

UPPER KEYSWITCH ASSEMBLY

Part	Description	Schematic Reference	Part Number
Actuator	Keyswitch		964-024116
Clip	Spring		976-009364-002
Coil	70 mh	L2, 23, 25	956-018877
Diode	Scan Keyswitch		919-024769
Spring	Contact		917-015558
Spring	Pulldown		975-007085

UPPER, LOWER FLUTE KEYER BOARD ASSEMBLY

Part	Description	Schematic Reference	Part Number
Diode		D534, 436, 537	919-024769
Diode		D533, 535	919-004799
Transistor	Flute Keyer	Q275, 276	991-026315

UPPER R/S KEYING CONTROL & AOC BOARD ASSEMBLY

Part	Description	Schematic Reference	Part Number
Capacitor	Electrolytic 2x30 uf 25V Dual		945-022781
Diode		D21, 22, 890	919-024769
Potentiometer	5K 20% AOC Range Adjustment	VR57	925-004349-005
Transistor		Q555,557,559,561,563,565, 567,569,571,573,575,577	991-008393
Transistor		All others	991-010098
Transistor		Q552	991-020425-001
Transistor		Q553	991-020426-003

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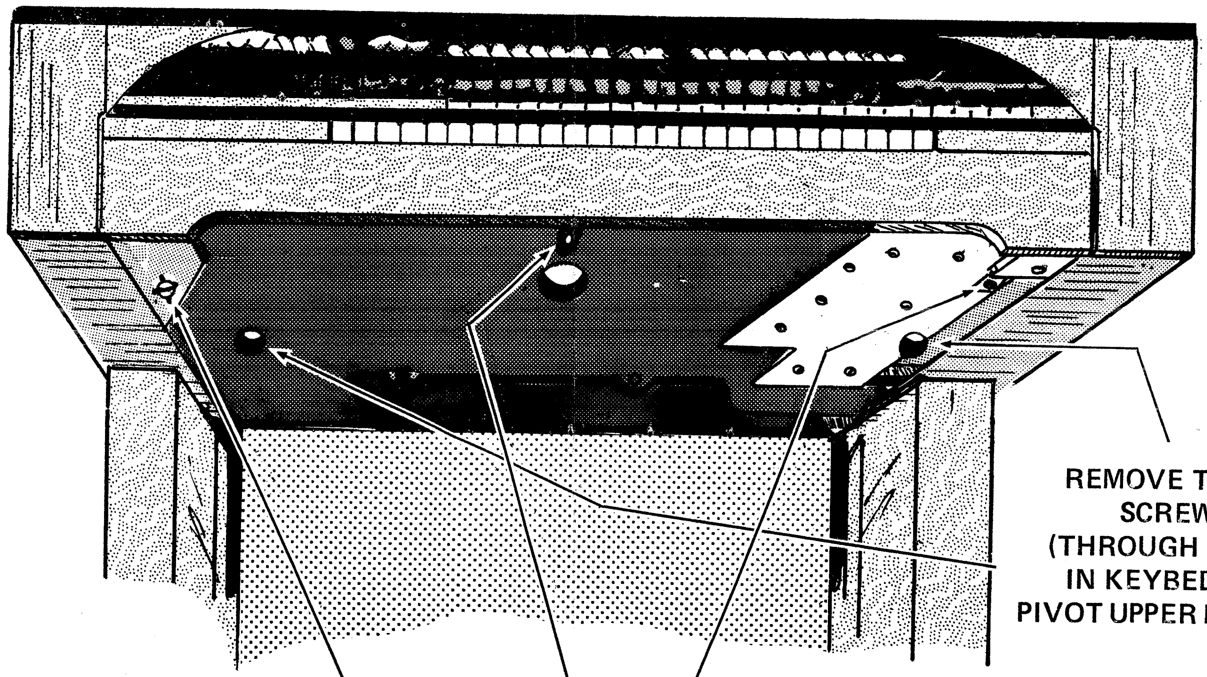
TO RAISE TOP, REMOVE TWO SCREWS UNDER MUSIC RACK.

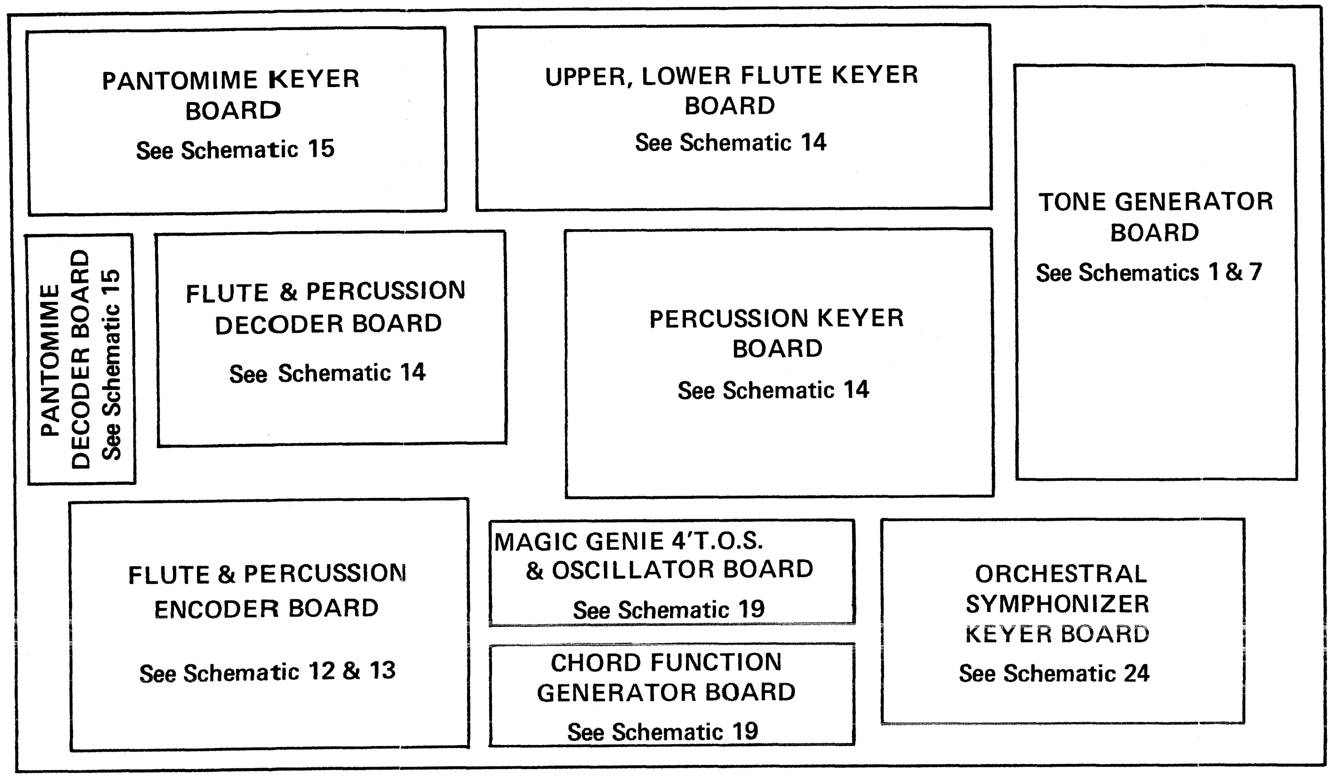


REMOVE THESE SCREWS (THROUGH HOLES IN KEYBED) TO PIVOT UPPER MANUAL

TO SLIDE TRAY ASSEMBLY BACK REMOVE THESE 3 SCREWS AND 2 SCREWS LOCATED ON EACH SIDE OF TRAY ASSEMBLY NEAR ORGAN SIDE PANELS. ALSO REVERB UNIT MUST BE REMOVED BEFORE SLIDING TRAYS BACK.

BOARD LOCATION DIAGRAM & SCHEMATIC REFERENCE

OUTER TRAY UP


PANTOMIME KEYER BOARD
See Schematic 15
UPPER, LOWER FLUTE KEYER BOARD
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TONE GENERATOR BOARD
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PANTOMIME DECODER BOARD
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PERCUSSION KEYER BOARD
See Schematic 14
FLUTE & PERCUSSION ENCODER BOARD
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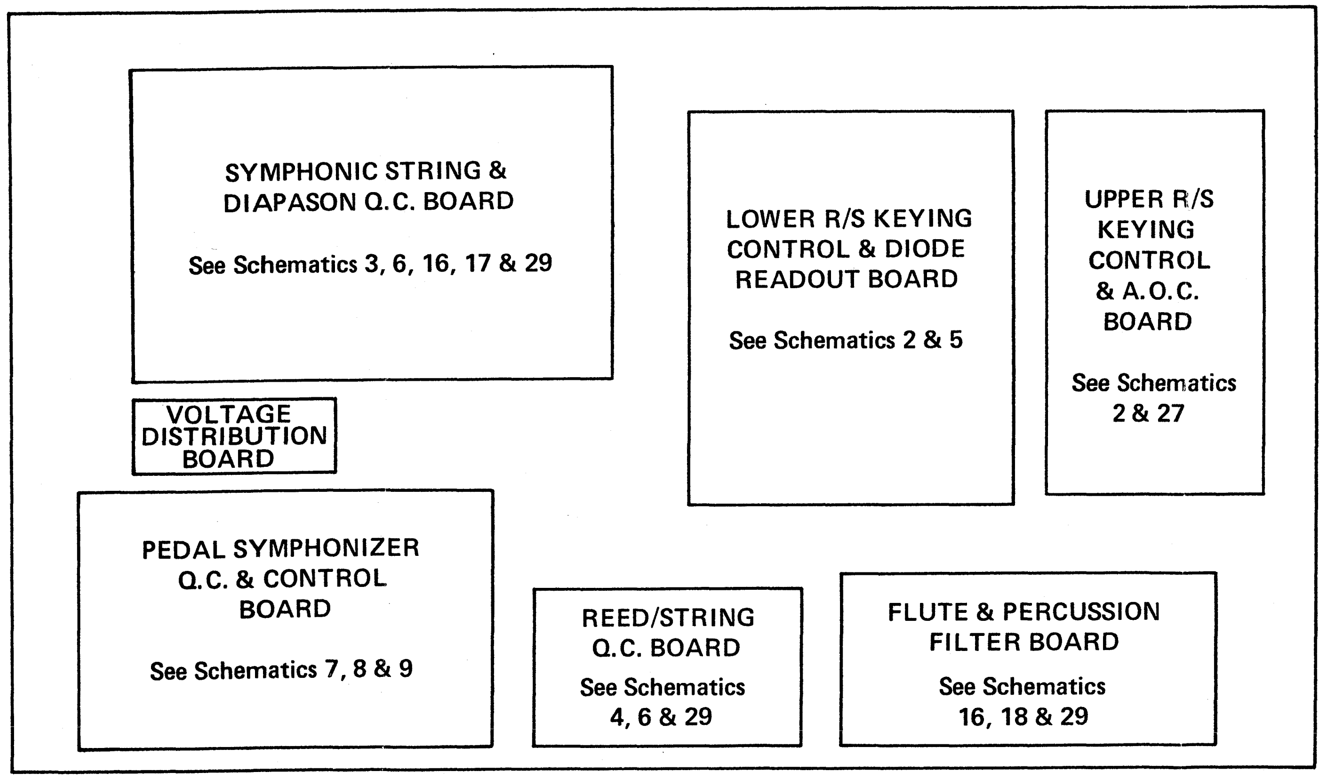
MAGIC GENIE 4'T.O.S. & OSCILLATOR BOARD
See Schematic 19
CHORD FUNCTION GENERATOR BOARD
See Schematic 19
ORCHESTRAL SYMPHONIZER KEYER BOARD
See Schematic 24

OUTER TRAY LOWERED


SYMPHONIC STRING & DIAPASON Q.C. BOARD
See Schematics 3, 6, 16, 17 & 29
LOWER R/S KEYING CONTROL & DIODE READOUT BOARD
See Schematics 2 & 5
UPPER R/S KEYING CONTROL & A.O.C. BOARD
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PEDAL SYMPHONIZER Q.C. & CONTROL BOARD
See Schematics 7, 8 & 9
REED/STRING Q.C. BOARD
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FLUTE & PERCUSSION FILTER BOARD
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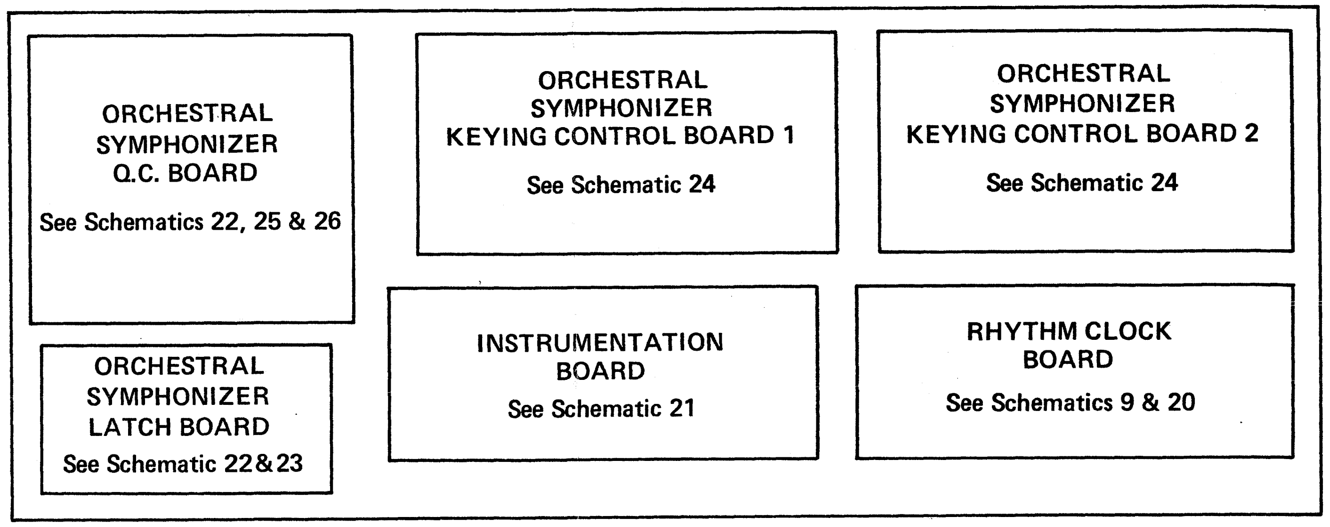
INNER TRAY UP


ORCHESTRAL SYMPHONIZER Q.C. BOARD
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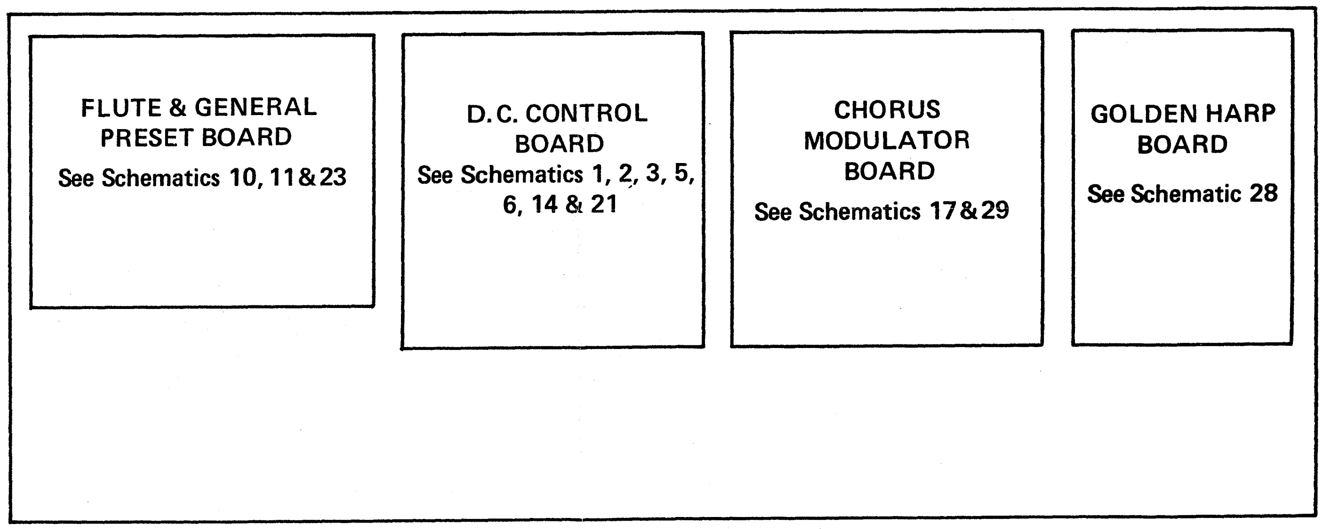
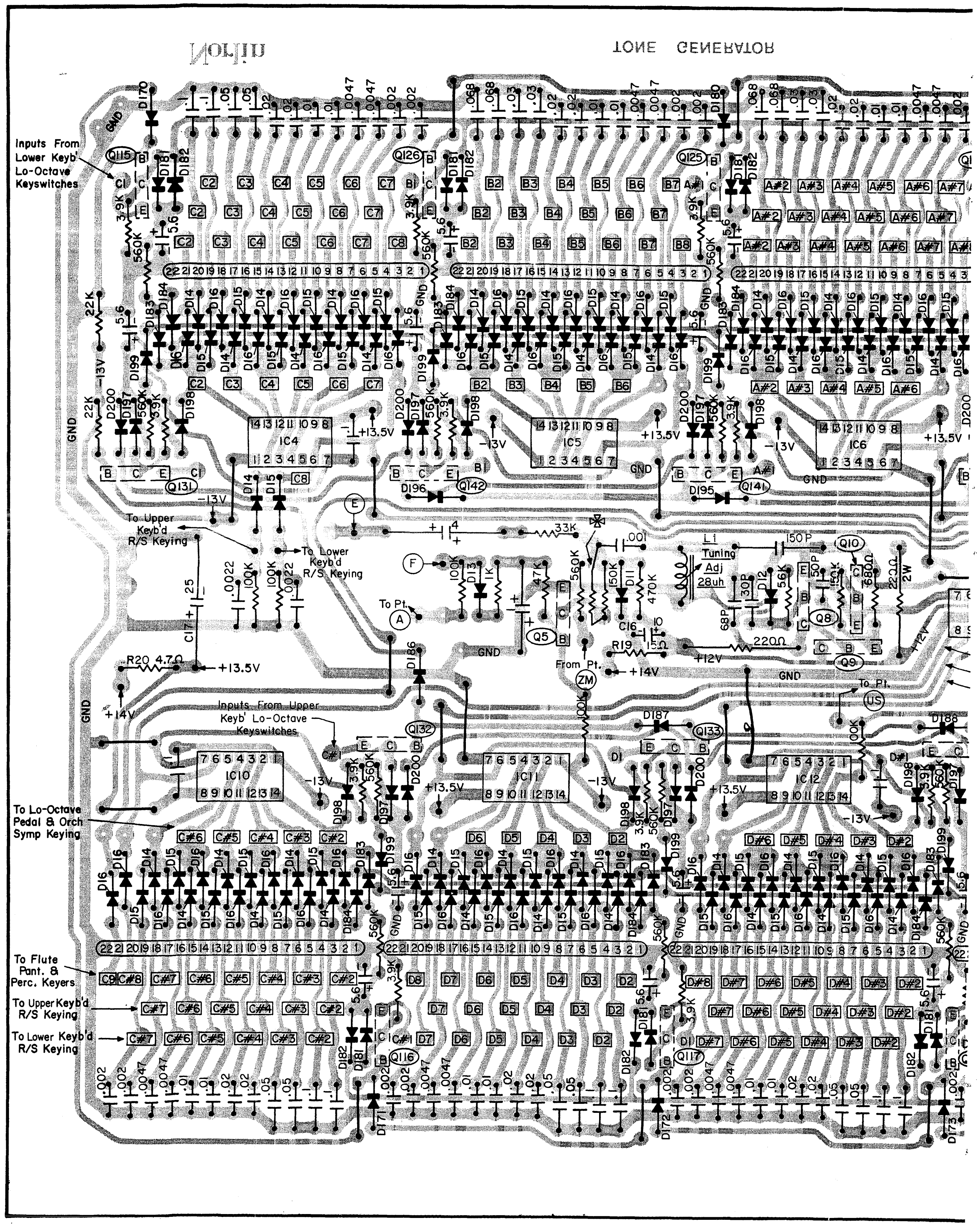
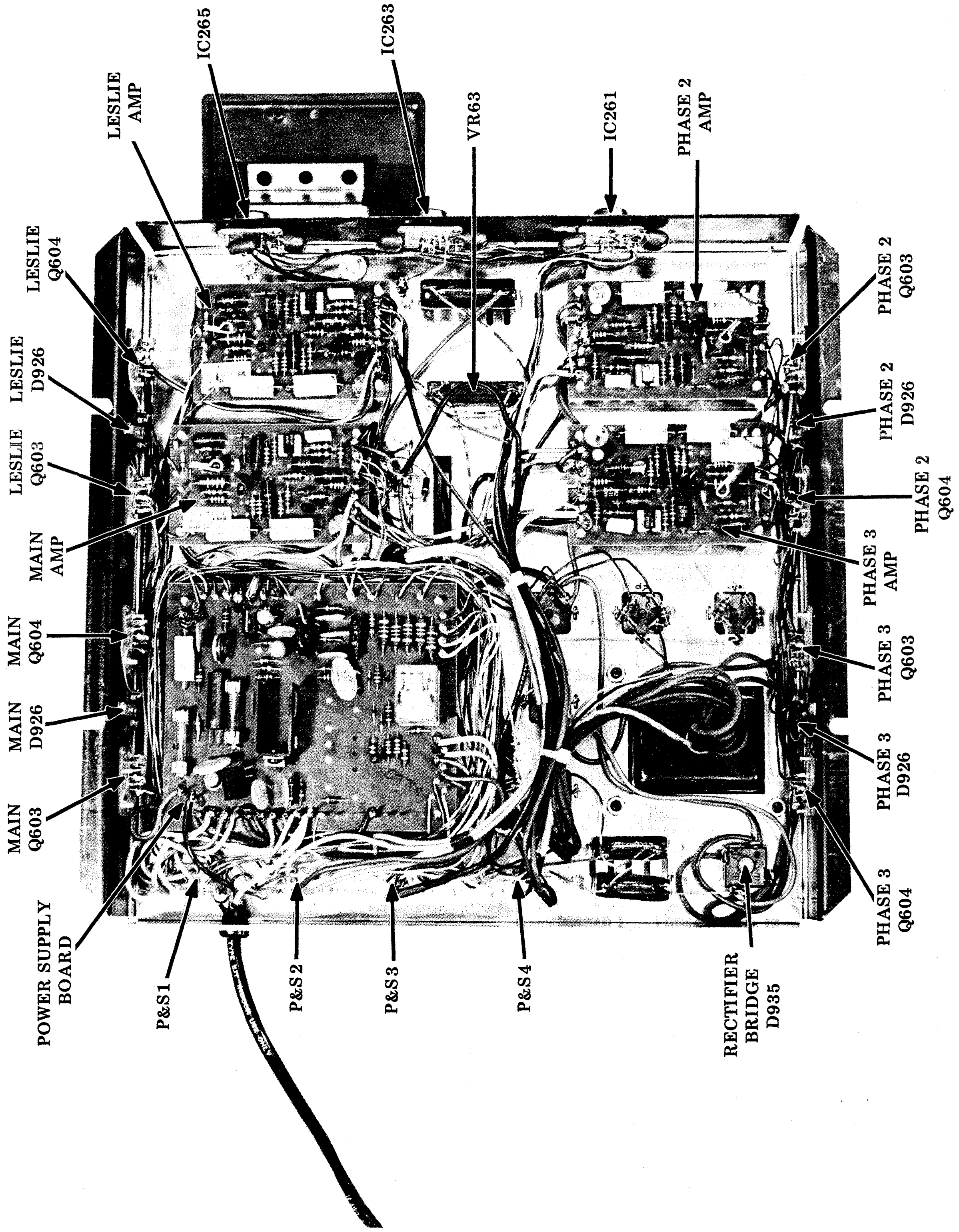
ORCHESTRAL SYMPHONIZER KEYING CONTROL BOARD 2
See Schematic 24
ORCHESTRAL SYMPHONIZER LATCH BOARD
See Schematic 22&23
INSTRUMENTATION BOARD
See Schematic 21
RHYTHM CLOCK BOARD
See Schematics 9 & 20

INNER TRAY LOWERED

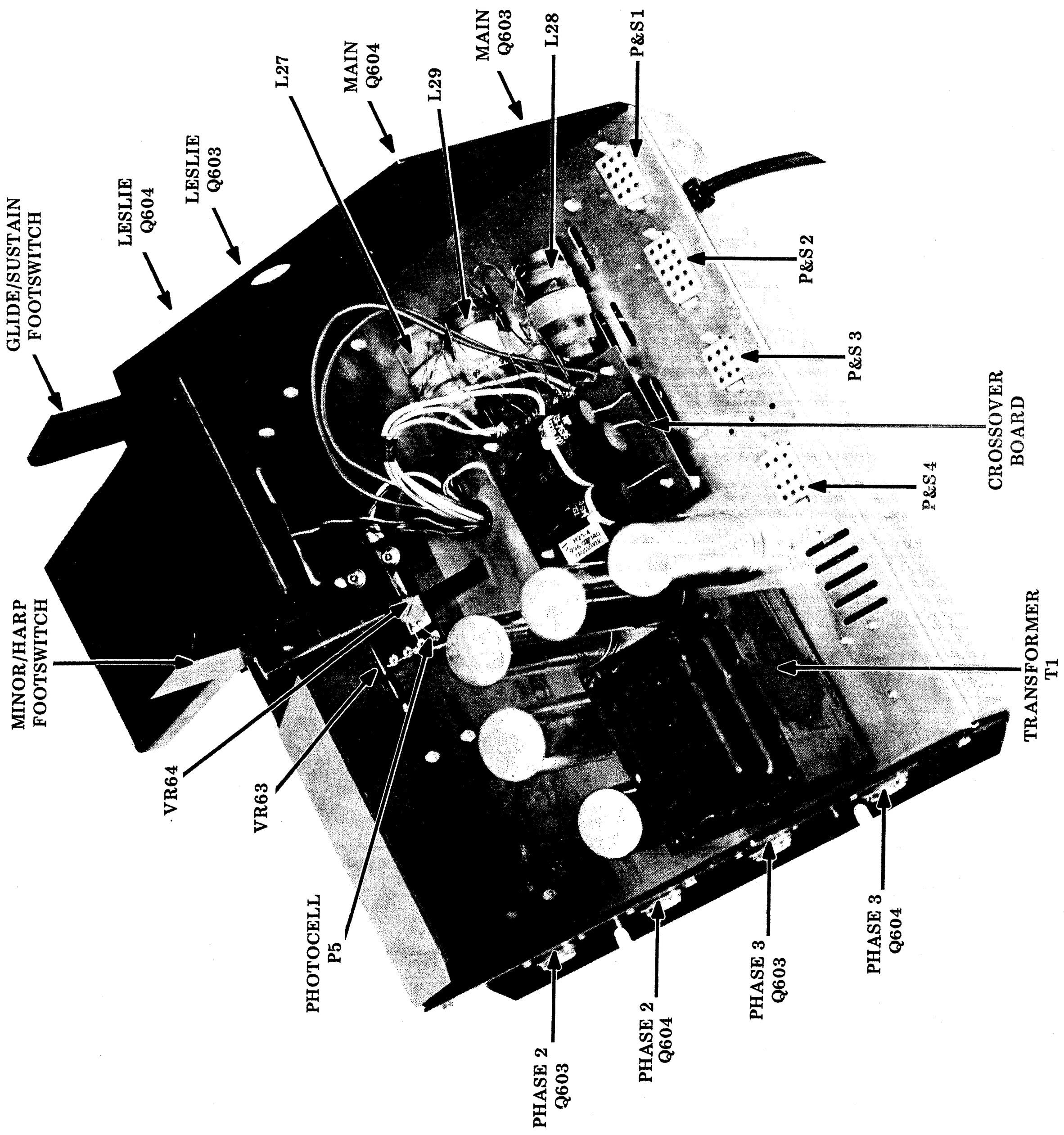

FLUTE & GENERAL PRESET BOARD
See Schematics 10, 11&23
D.C. CONTROL BOARD
See Schematics 1, 2, 3, 5, 6, 14 & 21
CHORUS MODULATOR BOARD
See Schematics 17&29
GOLDEN HARP BOARD
See Schematic 28


Norlin
TONE GENERATOR
Inputs From Lower Keyb' Lo-Octave Keyswitches
To Upper Keyb'd R/S Keying
To Lower Keyb'd R/S Keying
To Pt. A
From Pt. ZM
To Pt. US
L1 Tuning Adj 28uh
Inputs From Upper Keyb' Lo-Octave Keyswitches
To Lo-Octave Pedal & Orch Symp Keying
To Flute Pont. & Perc. Keyers
To Upper Keyb'd R/S Keying
To Lower Keyb'd R/S Keying
IC4
IC5
IC6
IC10
IC11
IC12
+13.5V
-13V
+14V
+12V
GND


IC265
IC263
VR63
IC261
LESLIE AMP
PHASE 2 AMP
LESLIE Q604
LESLIE D926
LESLIE Q603
MAIN AMP
MAIN Q604
MAIN D926
MAIN Q603
POWER SUPPLY BOARD
P&S1
P&S2
P&S3
P&S4
RECTIFIER BRIDGE D935
PHASE 2 Q603
PHASE 2 D926
PHASE 2 Q604
PHASE 3 AMP
PHASE 3 Q603
PHASE 3 D926
PHASE 3 Q604

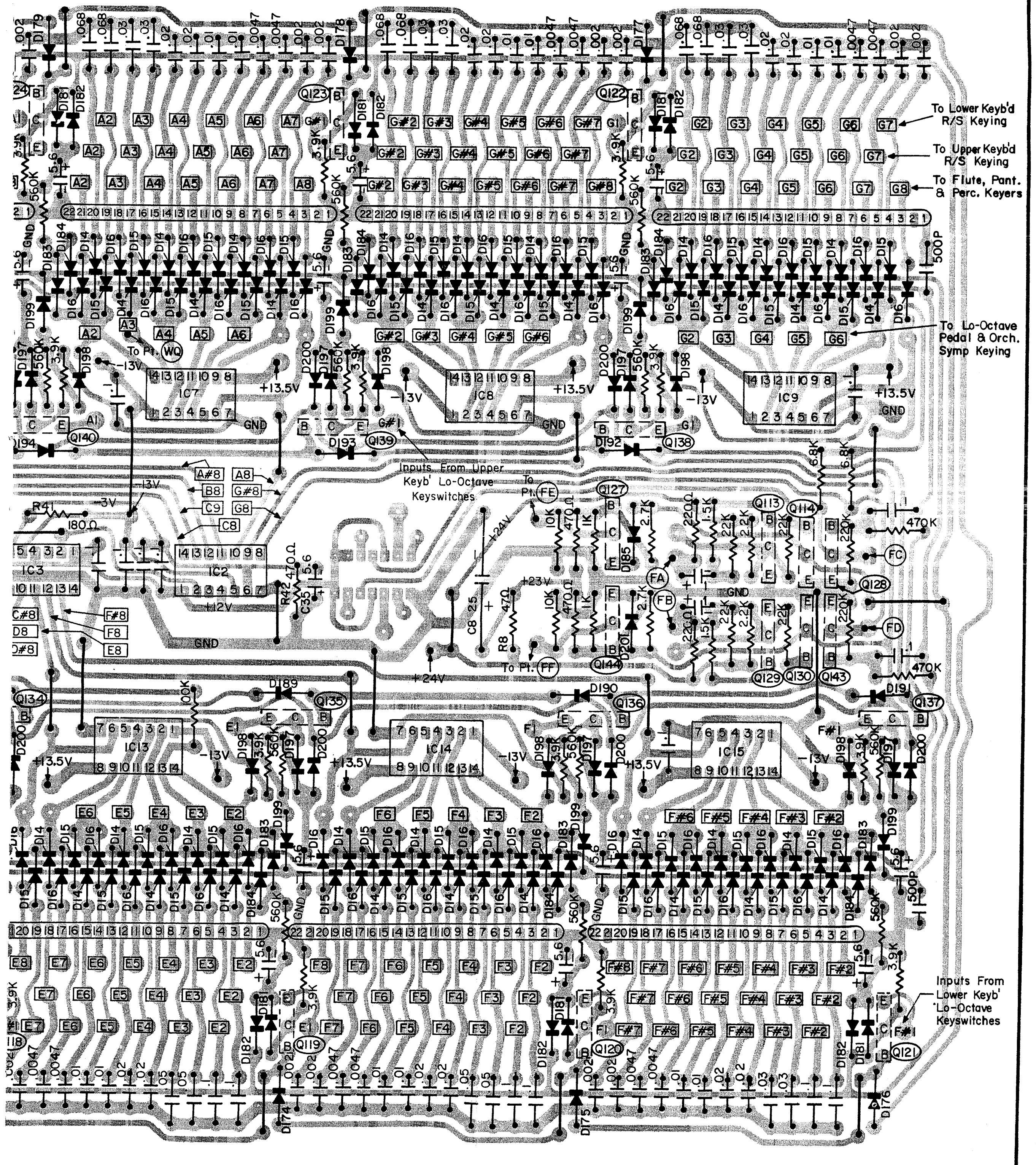
AMPLIFIER/POWER SUPPLY & EXPRESSION PEDAL ASSEMBLY
(Bottom View)

AMPLIFIER/POWER SUPPLY & EXPRESSION PEDAL ASSEMBLY
(Top View)

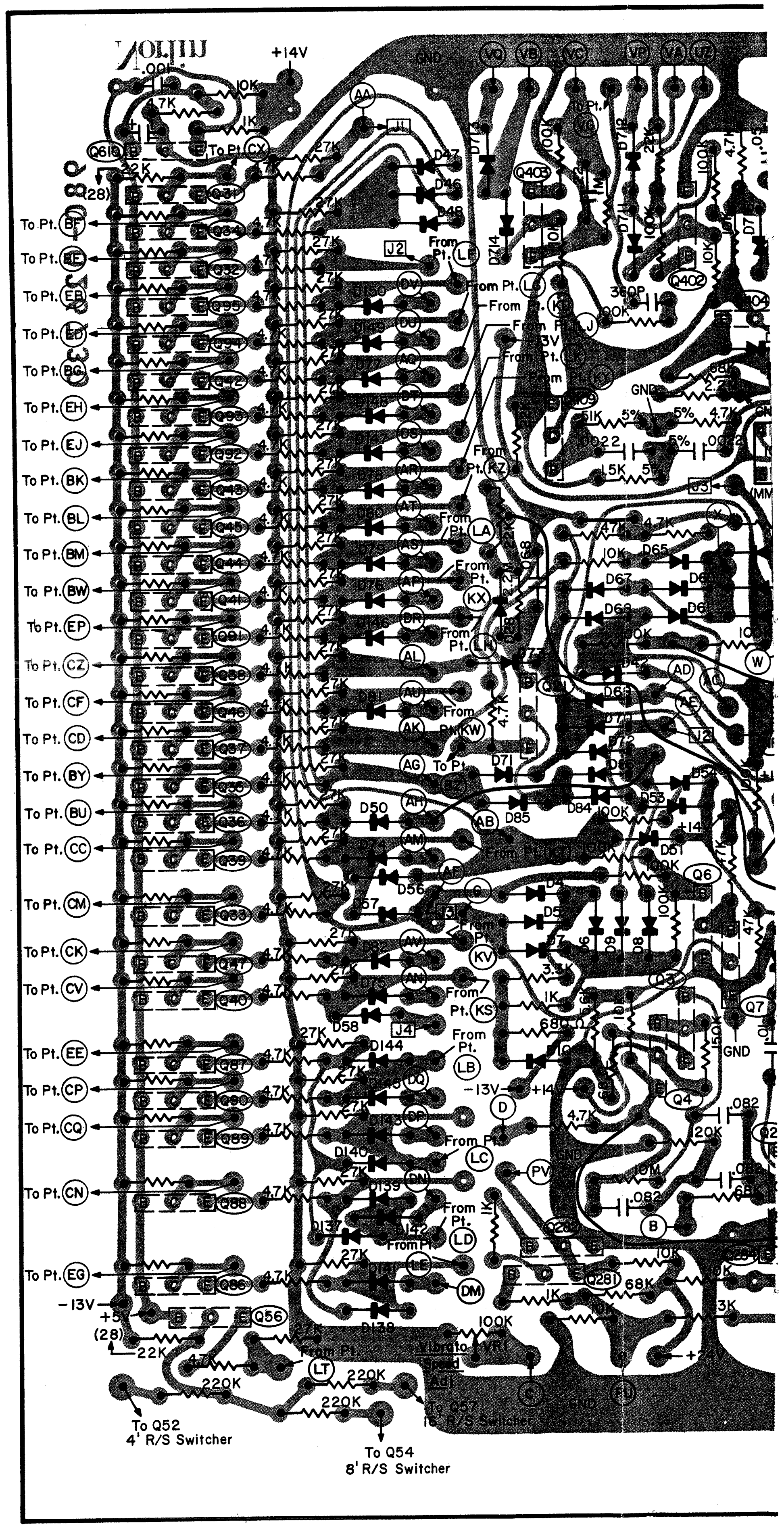

GLIDE/SUSTAIN FOOTSWITCH
LESLIE Q604
LESLIE Q603
L27
MAIN Q604
L29
MAIN Q603
L28
P&S1
P&S2
P&S 3
P&S4
CROSSOVER BOARD
TRANSFORMER T1
MINOR/HARP FOOTSWITCH
VR64
VR63
PHOTOCELL P5
PHASE 2 Q603
PHASE 2 Q604
PHASE 3 Q603
PHASE 3 Q604

R BOARD

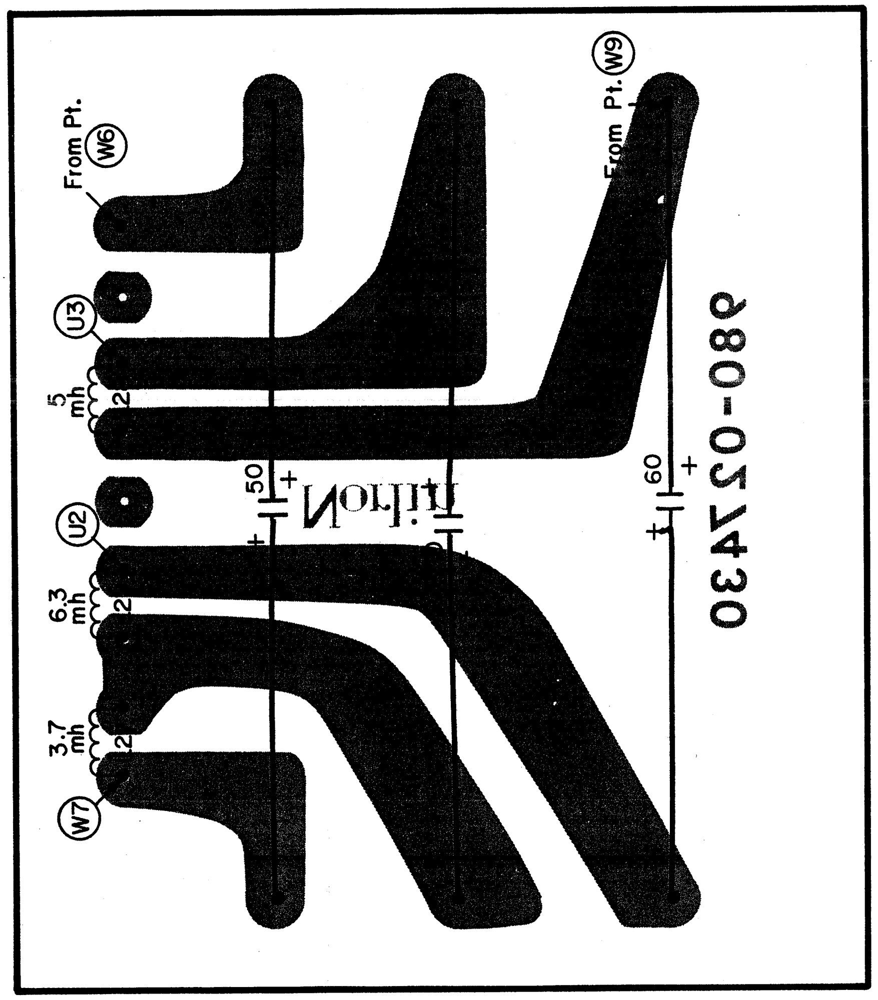
Denotes Factory Tailored Component


To Lower Keyb'd R/S Keying
To Upper Keyb'd R/S Keying
To Flute, Pant. & Perc. Keyers
To Lo-Octave Pedal & Orch. Symp Keying
Inputs From Upper Keyb' Lo-Octave Keyswitches
Inputs From Lower Keyb' Lo-Octave Keyswitches
IC7
IC8
IC9
IC2
IC3
IC13
IC14
IC15
+13.5V
-13V
GND
+24V
+23V
+12V
To Pt. FE
To Pt. FF
To Pt. WC

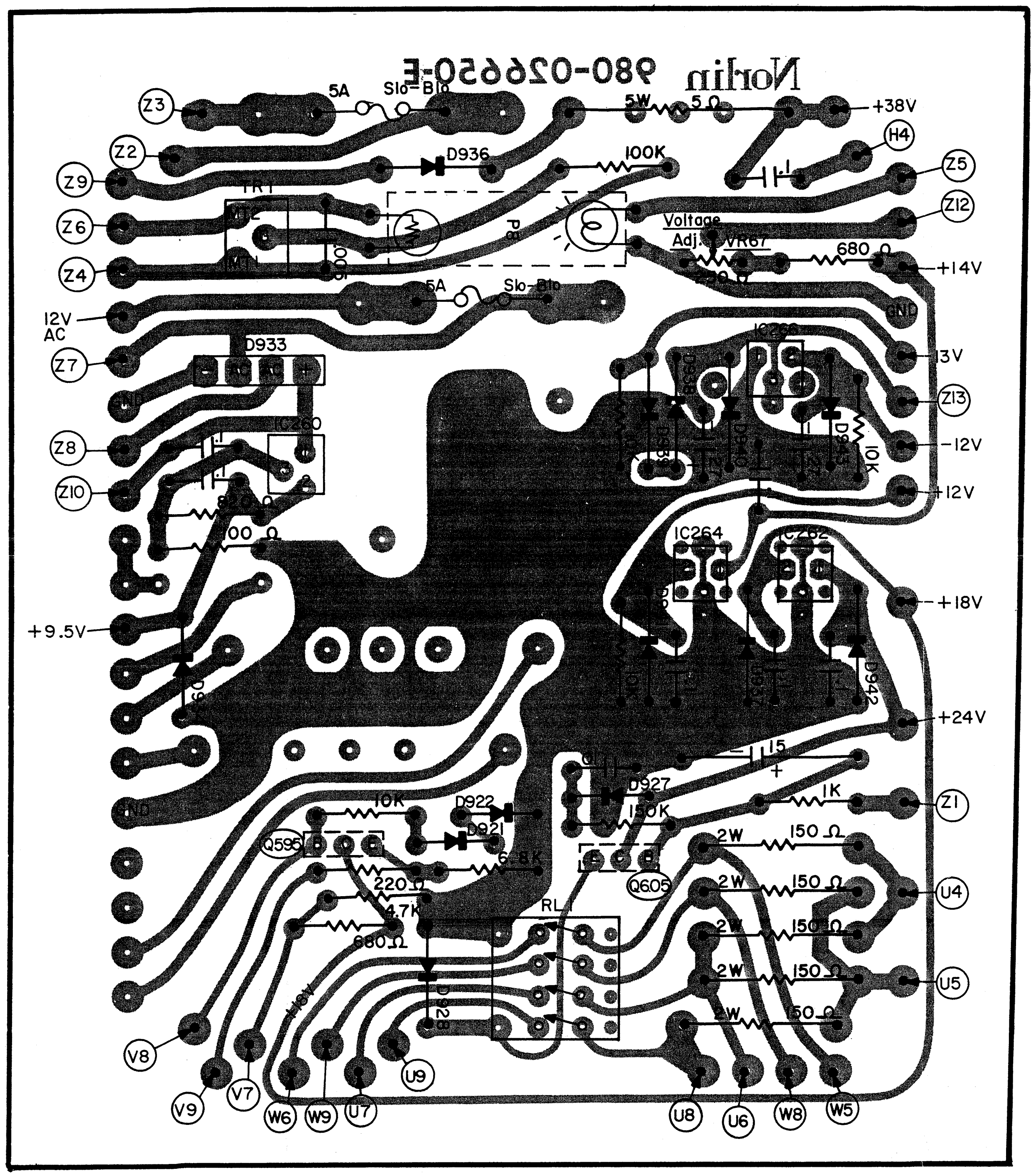
DC CONTROL BO


+14V
To Pt. BF
To Pt. BE
To Pt. EB
To Pt. ED
To Pt. BC
To Pt. EH
To Pt. EJ
To Pt. BK
To Pt. BL
To Pt. BM
To Pt. BW
To Pt. EP
To Pt. CZ
To Pt. CF
To Pt. CD
To Pt. BY
To Pt. BU
To Pt. CC
To Pt. CM
To Pt. CK
To Pt. CV
To Pt. EE
To Pt. CP
To Pt. CQ
To Pt. CN
To Pt. EG
-13V
+5V
To Q52
4' R/S Switcher
To Q54
8' R/S Switcher
To Q57
16' R/S Switcher
Vibrato Speed Adj
GND

CROSSOVER BOARD

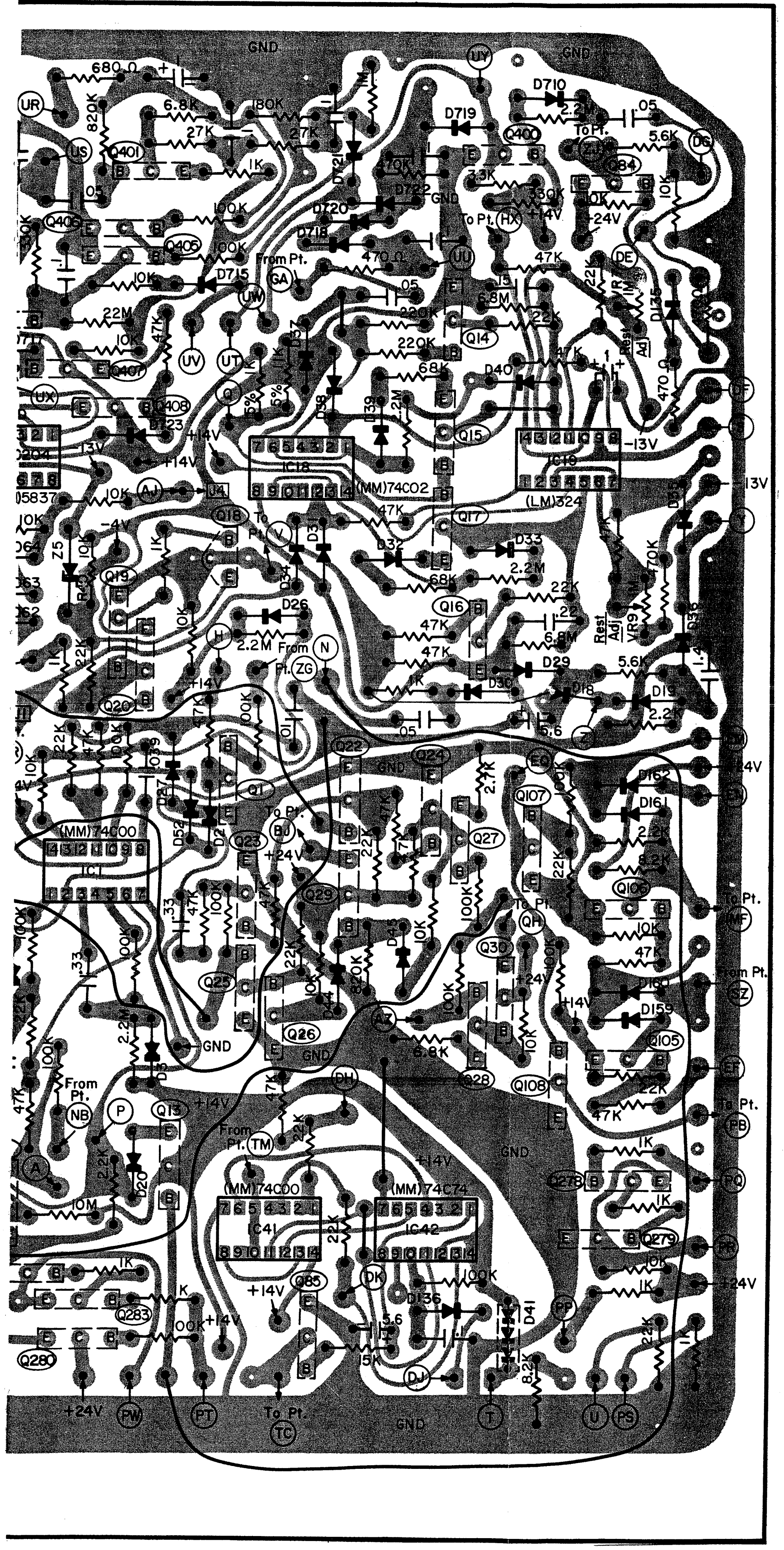

From Pt. W6
From Pt. W9
U3
U2
W7
5 mh
6.3 mh
3.7 mh
50
60

POWER SUPPLY BD.

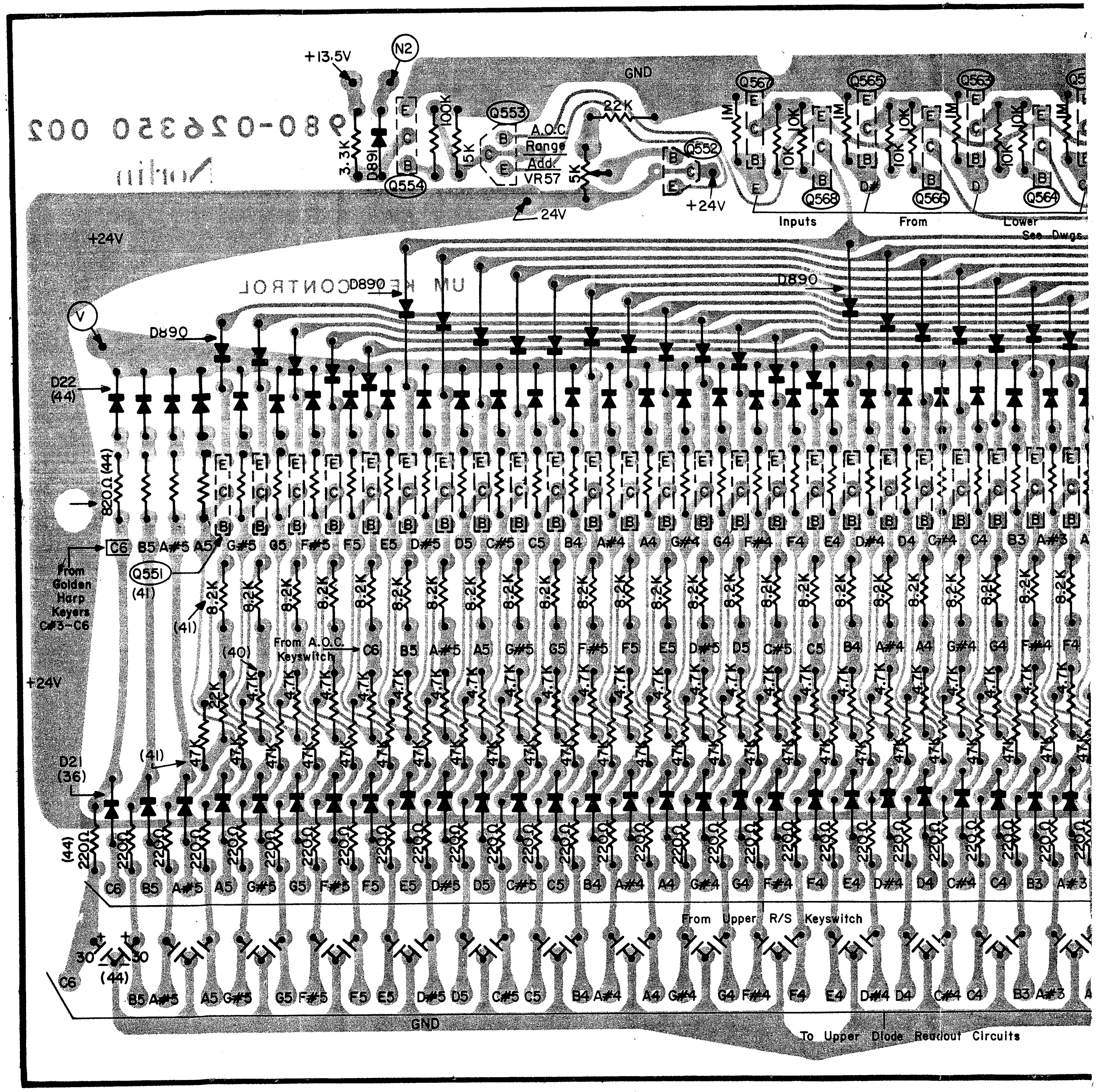

Norlin 980-026650-E
5A
Slo-Blo
5W
5Ω
+38V
D936
100K
Voltage Adj. VR67
680 Ω
+14V
TR1
PB
12V AC
D933
IC260
IC262
IC264
+13V
-12V
+12V
+18V
+9.5V
+24V
D942
D927
D922
D921
10K
150K
6.8K
1K
220Ω
4.7K
680Ω
15
RL
2W
150 Ω
Q595
Q605
Z1
Z2
Z3
Z4
Z5
Z6
Z7
Z8
Z9
Z10
Z12
Z13
H4
U4
U5
U6
U7
U8
U9
V7
V8
V9
W5
W6
W8
W9

ARD

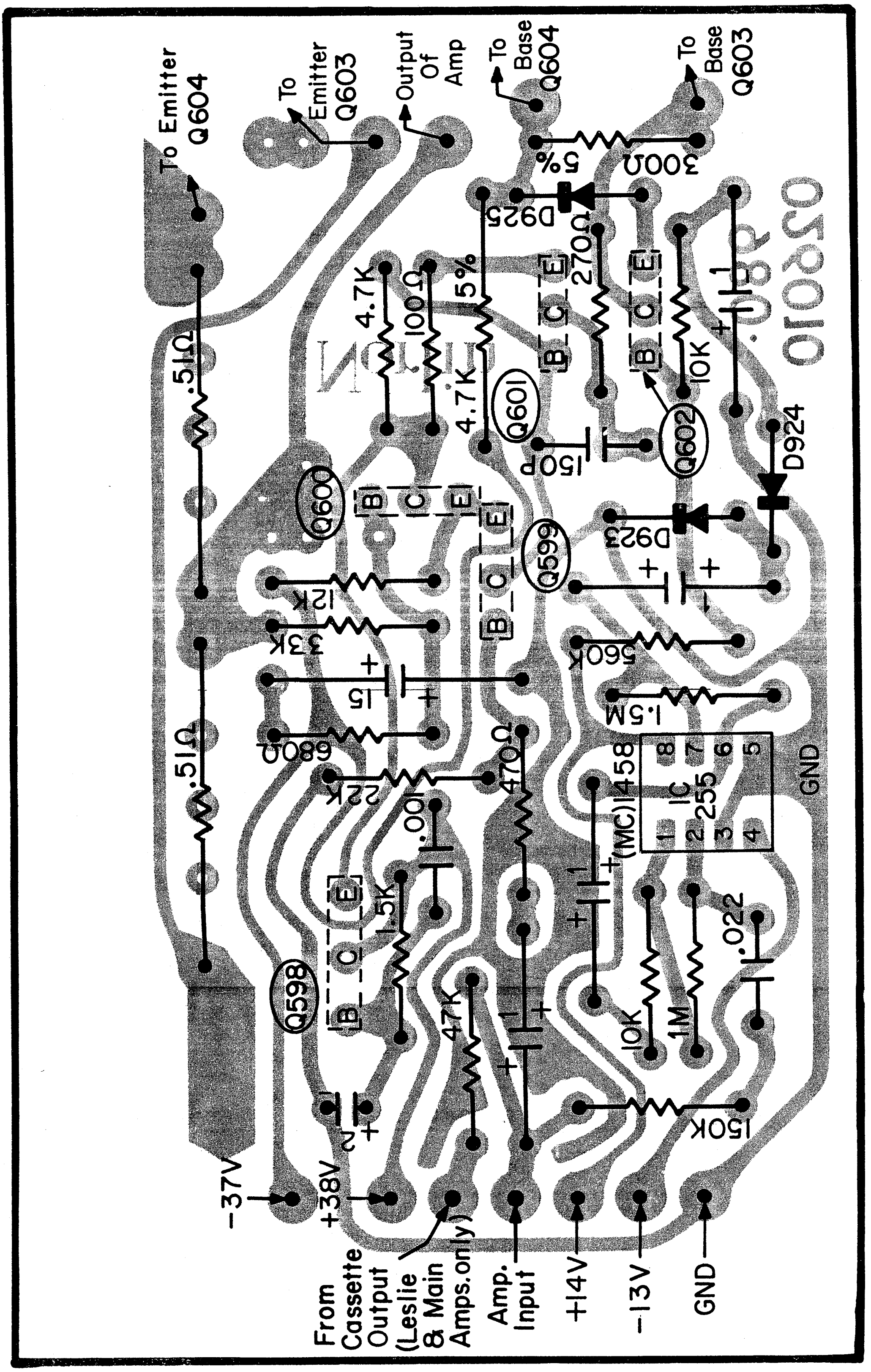
Like J Numbers indicate on board jumpers.


GND
680 Ω
820K
6.8K
27K
180K
D710
D719
D720
D722
D718
D715
D723
Q400
Q401
Q405
Q406
Q407
Q408
IC18 (MM)74C02
IC19 (LM)324
IC1 (MM)74C00
IC41 (MM)74C00
IC42 (MM)74C74
Rest Adj. VR9
Q14
Q15
Q16
Q17
Q18
Q19
Q20
Q22
Q23
Q24
Q25
Q26
Q27
Q28
Q29
Q30
Q85
Q105
Q106
Q107
Q108
Q13
Q278
Q279
Q280
Q283
D26
D29
D30
D32
D33
D36
D41
D159
D161
D162
+14V
+24V
-13V
From Pt.
To Pt.
UR
US
UY
UV
UT
UW
UX
UU
GA
DE
DF
DG
DH
DJ
DK
AZ
N
ZG
NB
P
A
PW
PT
TC
T
U
PS
TM
PF

UPPER R/S KEYING CONTROL



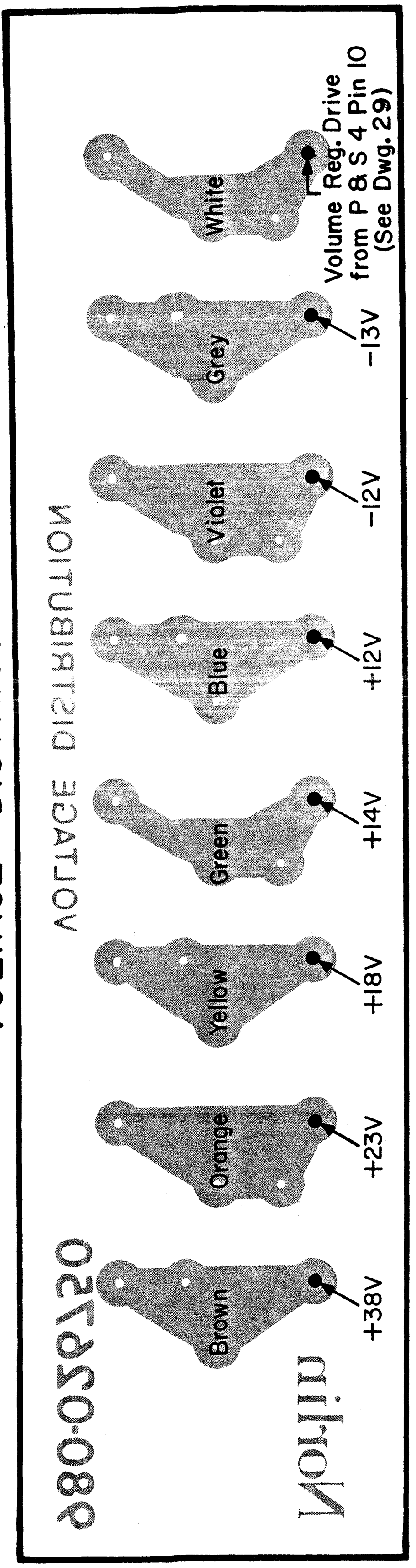
+13.5V
N2
GND
Q553
A.O.C. Range Adj. VR57
22K
Q552
+24V
24V
Q554
3.3K
D891
100K
5K
Q567
Q565
Q563
Q568
Q566
Q564
1M
10K
Inputs
From
Lower
See Dwgs.
+24V
D890
D890
V
D22 (44)
820Ω (44)
C6
B5
A#5
A5
G#5
G5
F#5
F5
E5
D#5
D5
C#5
C5
B4
A#4
A4
G#4
G4
F#4
F4
E4
D#4
D4
C#4
C4
B3
A#3
Q551 (41)
From Golden Harp Keyers C#3-C6
(41)
(40)
From A.O.C. Keyswitch
8.2K
4.7K
47K
+24V
D21 (36)
(41)
(44) 220Ω
From Upper R/S Keyswitch
30
(44)
GND
To Upper Diode Readout Circuits



To Emitter Q604
To Emitter Q603
Output Of Amp
To Base Q604
To Base Q603
300Ω
5%
D925
270Ω
4.7K
100Ω
5%
4.7K
B C E
B C E
10K
1
.51Ω
Q601
150P
Q602
D924
Q600
B C E
D923
Q599
B C E
12K
3.3K
15
560K
1.5M
680Ω
.51Ω
22K
470Ω
.001
(MC)1458 IC 255
1 2 3 4 5 6 7 8
GND
.51K
Q598
B C E
4.7K
10K
1M
.022
150K
-37V
+38V
From Cassette Output (Leslie & Main Amps.only)
Amp. Input
+14V
-13V
GND

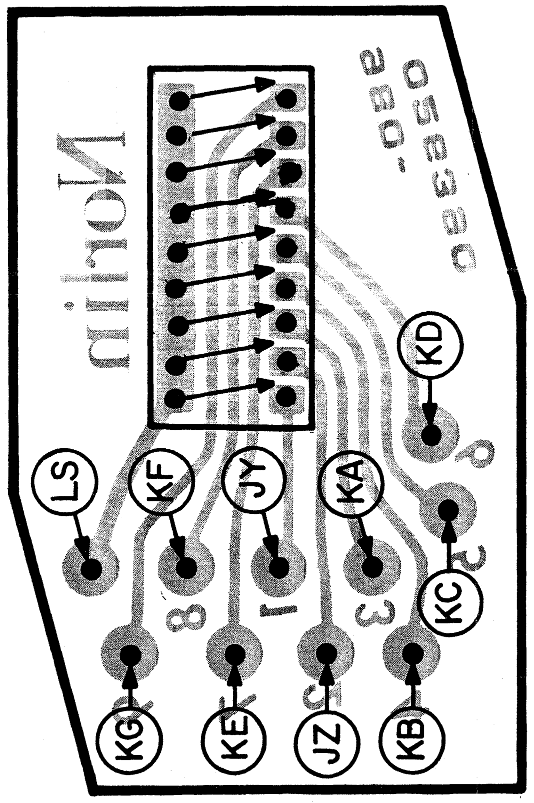
AMPLIFIER BOARD
(1 Of 4 Typical Amps)

VOLTAGE DISTRIBUTION

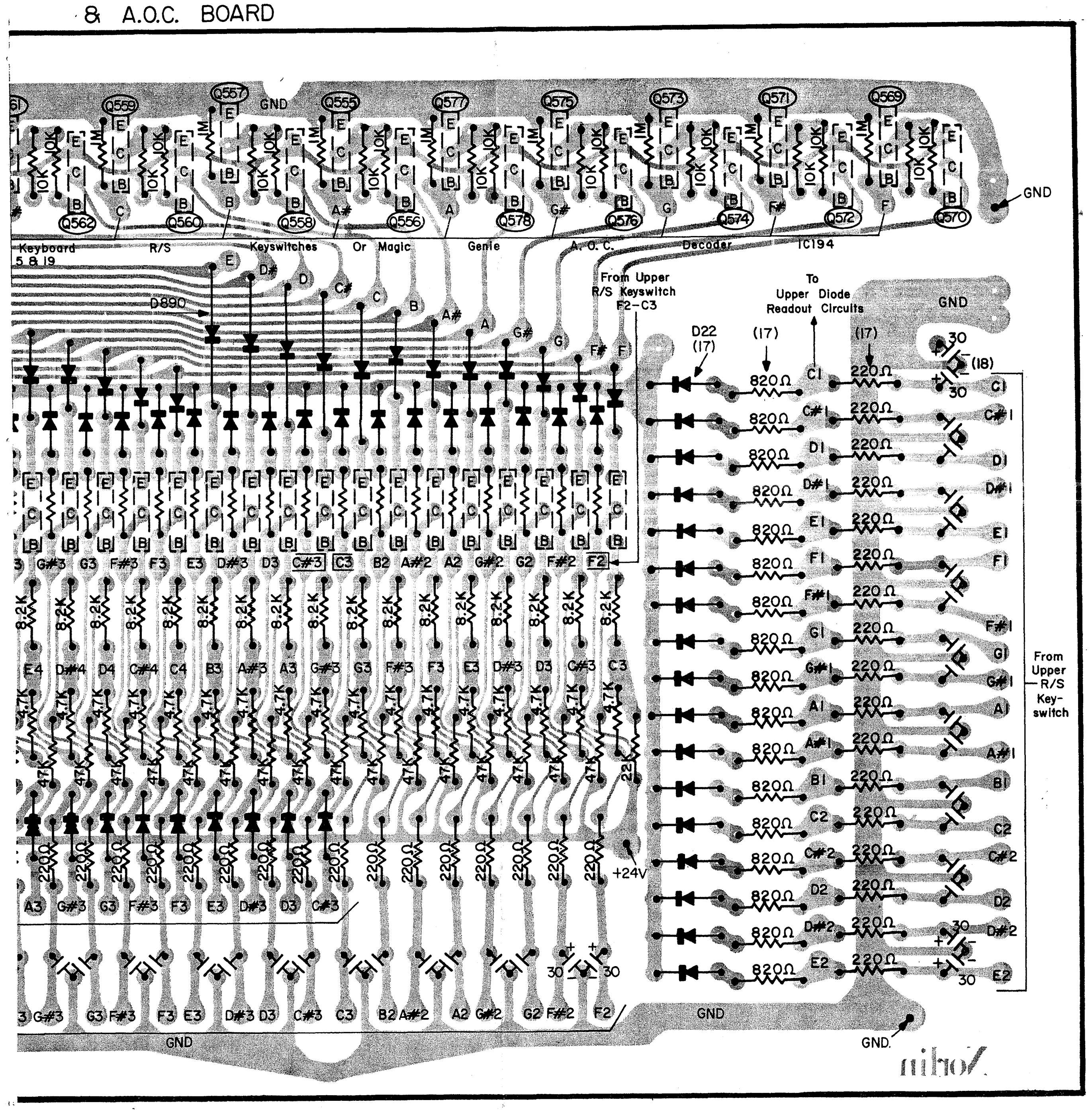

White
Grey
Violet
Blue
Green
Yellow
Orange
Brown
Volume Reg. Drive from P & S 4 Pin 10 (See Dwg. 29)
−13V
−12V
+12V
+14V
+18V
+23V
+38V
Norlin

FLUTE PRESET 3

(Located at Tab Panel)

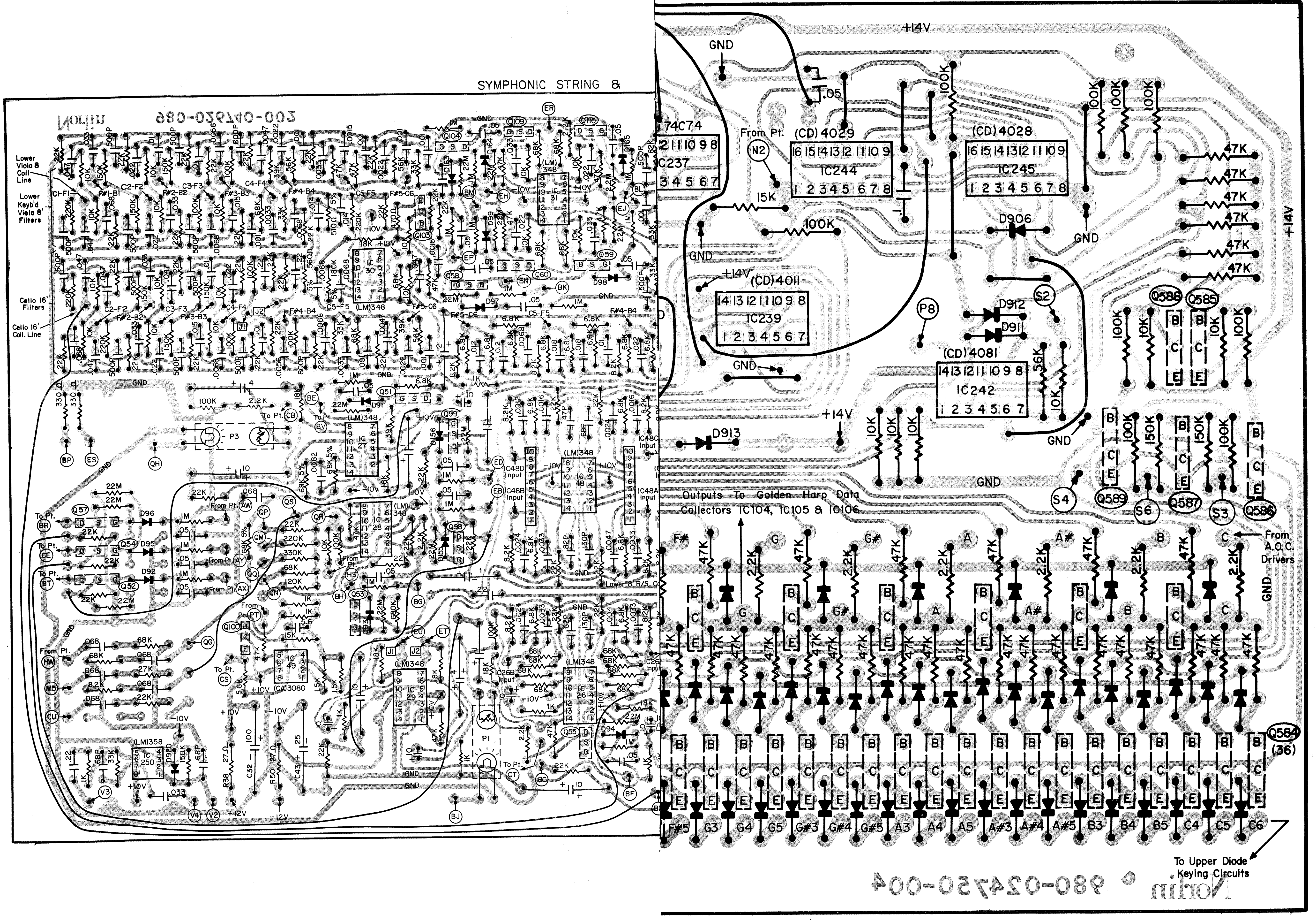

LS
KF
JY
KA
KD
KG
KE
JZ
KB
KC
Norlin

& A.O.C. BOARD

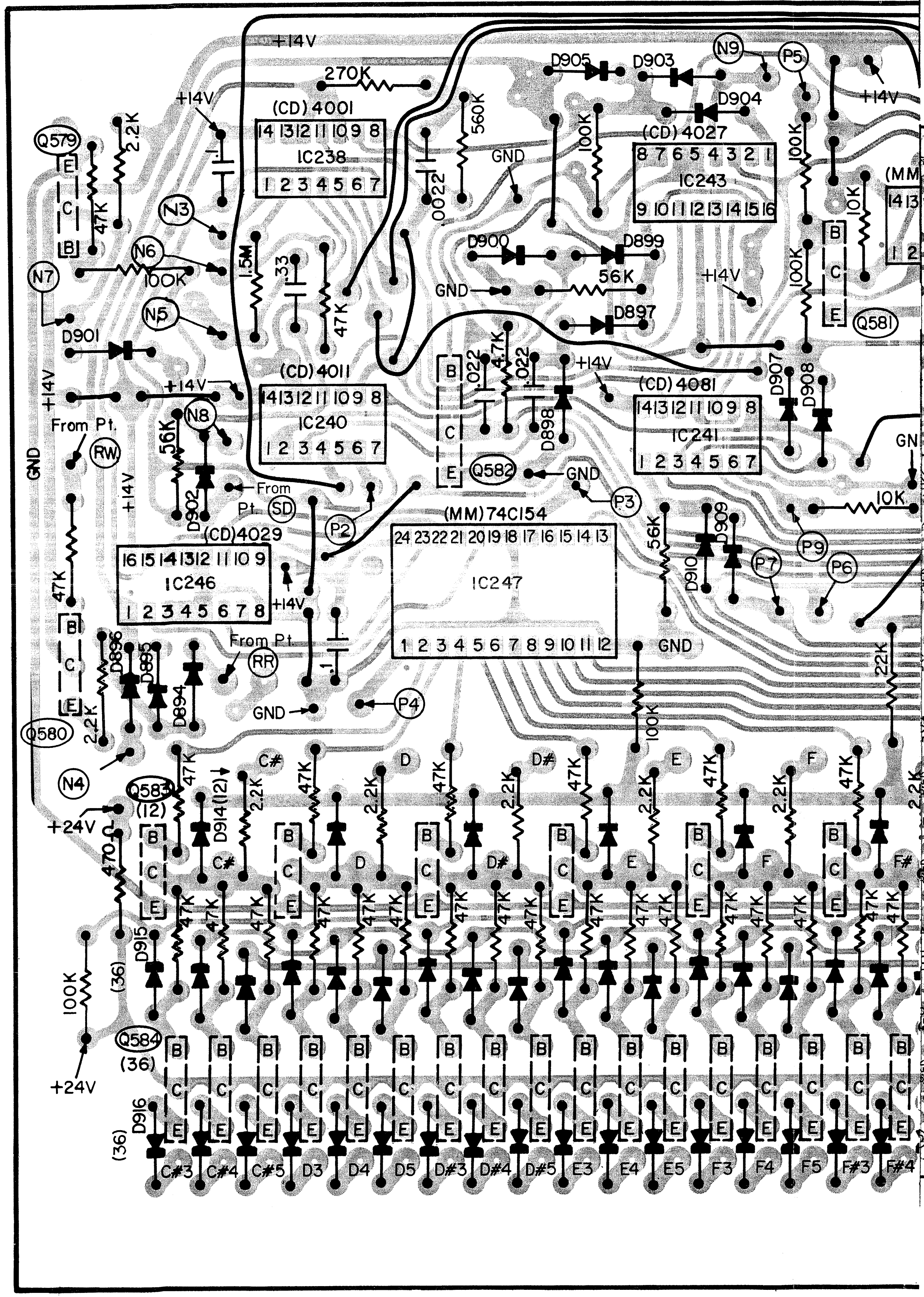

GND
Keyboard 5 & 19
R/S
Keyswitches
Or Magic
Genie
A.O.C.
Decoder
IC194
From Upper R/S Keyswitch F2−C3
To Upper Diode Readout Circuits
D22 (17)
(17)
D890
820Ω
220Ω
8.2K
4.7K
47K
+24V
30
(18)
From Upper R/S Key-switch
C1
C#1
D1
D#1
E1
F1
F#1
G1
G#1
A1
A#1
B1
C2
C#2
D2
D#2
E2
GND.
Norlin

SYMPHONIC STRING &

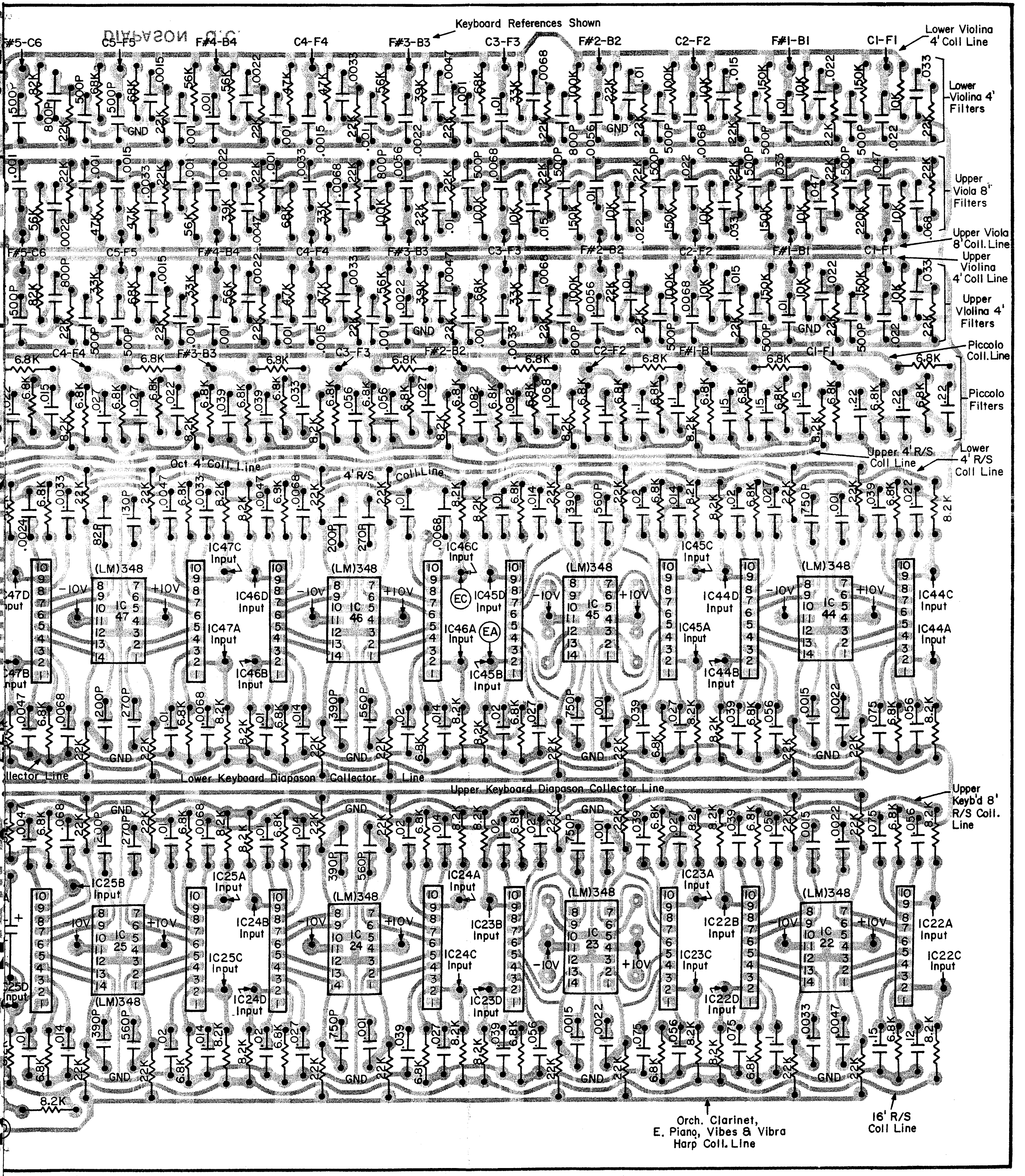
P BOARD


Lower Viola 8' Coll. Line
Lower Keyb'd Viola 8' Filters
Cello 16' Filters
Cello 16' Coll. Line
C1-F1
F#1-B1
C2-F2
F#2-B2
C3-F3
F#3-B3
C4-F4
F#4-B4
C5-F5
F#5-C6
(LM)348
IC 30
IC 31
IC 27
IC 28
IC 48
IC 29
IC 26
IC 49
(CA)3080
(LM)358
IC 250
IC48C Input
IC48D Input
IC48B Input
IC48A Input
IC26B Input
Lower 8' R/S Coll
P3
P1
+10V
-10V
+12V
-12V
GND
To Pt. BR
To Pt. CE
To Pt. BT
From Pt. AW
From Pt. AY
From Pt. AX
From Pt. HM
To Pt. CS
To Pt. CB
To Pt. BV
To Pt. CT
From Pt. PT
Outputs To Golden Harp Data Collectors IC104, IC105 & IC106
(CD)4029
IC244
(CD)4028
IC245
74C74
IC237
(CD)4011
IC239
(CD)4081
IC242
From Pt. N2
D906
D912
D911
D913
+14V
GND
Q584
(36)
From A.O.C. Drivers
To Upper Diode Keying Circuits
F#5
G3
G4
G5
G#3
G#4
G#5
A3
A4
A5
A#3
A#4
A#5
B3
B4
B5
C4
C5
C6

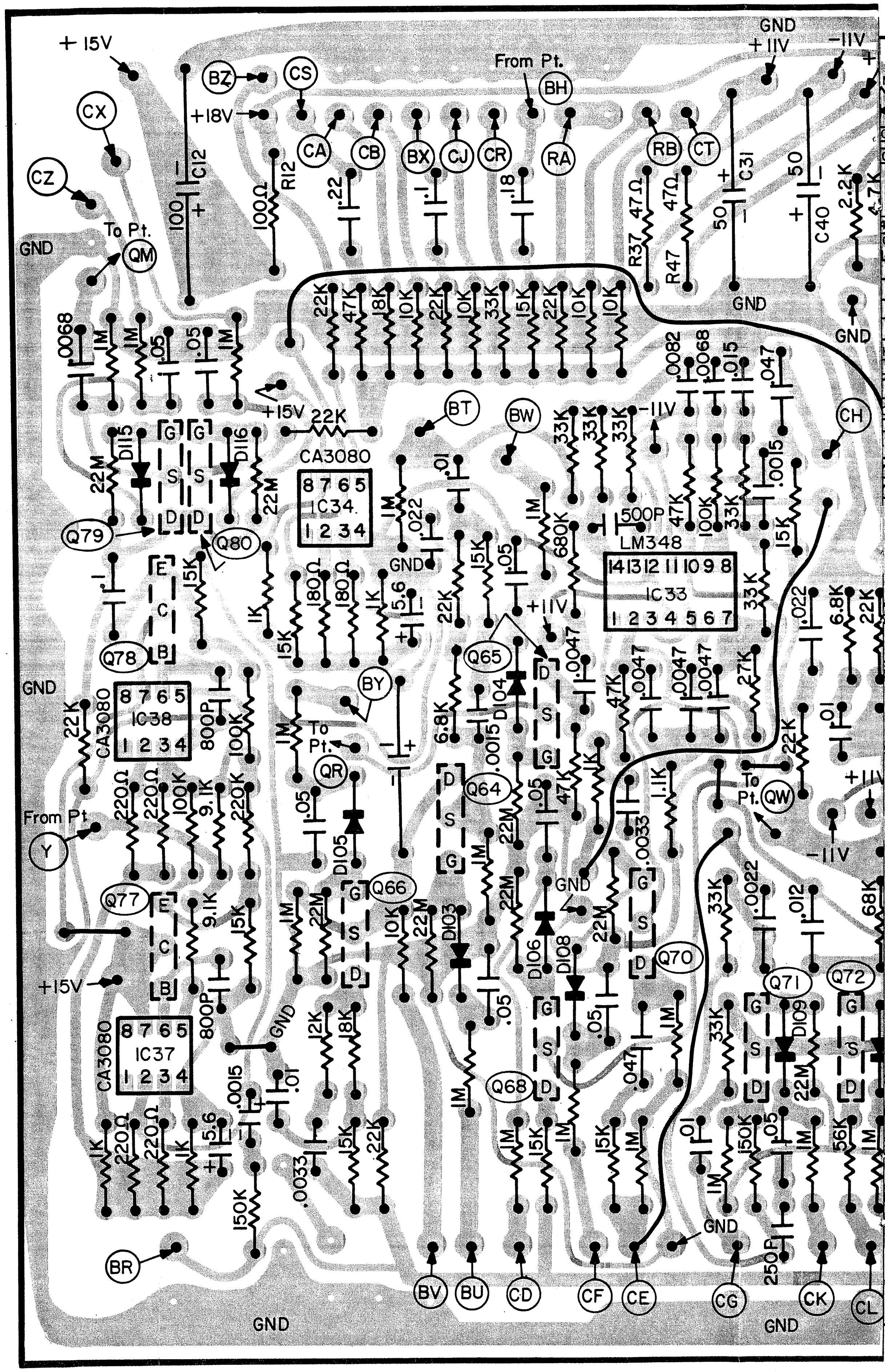
GOLDEN HAR


+14V
270K
(CD) 4001
IC238
D905
D903
D904
N9
P5
(CD) 4027
IC243
560K
100K
GND
.0022
Q579
2.2K
47K
N3
N6
100K
N7
1.5M
.33
D900
D899
56K
GND
D897
N5
D901
(CD) 4011
IC240
.022
4.7K
D898
(CD) 4081
IC241
D907
D908
Q581
From Pt. RW
N8
56K
D902
From Pt. SD
Q582
GND
P3
P2
(CD) 4029
IC246
(MM) 74C154
IC247
D909
D910
P9
P7
P6
10K
From Pt. RR
D896
D895
D894
Q580
GND
P4
N4
Q583 (12)
D914 (12)
+24V
470
D915 (36)
100K
Q584 (36)
+24V
D916
(36)
C#
D
D#
E
F
F#
C#3
C#4
C#5
D3
D4
D5
D#3
D#4
D#5
E3
E4
E5
F3
F4
F5
F#3
F#4

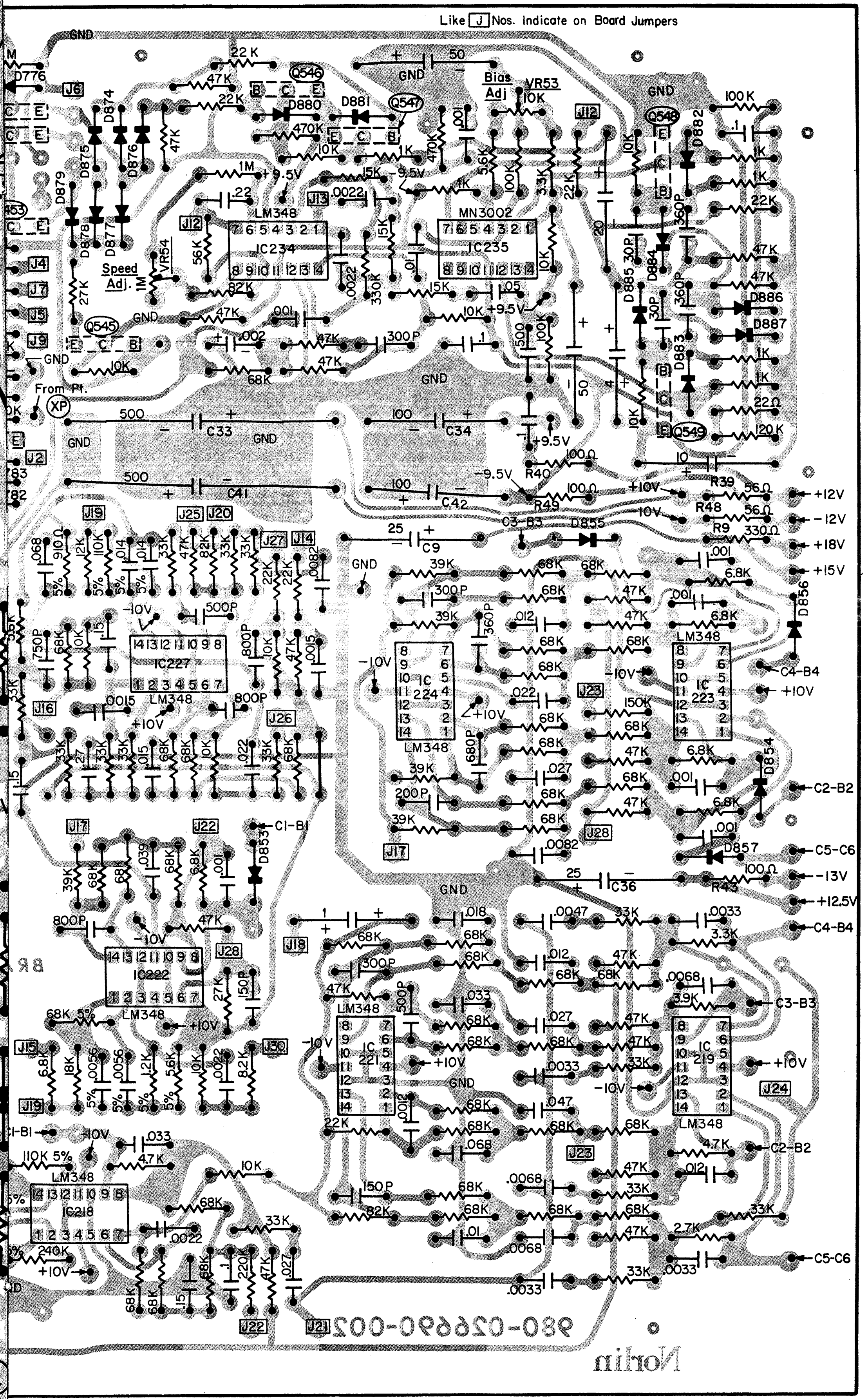
DIAPASON Q.C. BOARD


Keyboard References Shown
F#5-C6
C5-F5
F#4-B4
C4-F4
F#3-B3
C3-F3
F#2-B2
C2-F2
F#1-B1
C1-F1
Lower Violina 4' Coll Line
Lower Violina 4' Filters
Upper Viola 8' Filters
Upper Viola 8' Coll. Line
Upper Violina 4' Coll Line
Upper Violina 4' Filters
Piccolo Coll. Line
Piccolo Filters
Upper 4' R/S Coll. Line
Lower 4' R/S Coll Line
Oct 4' Coll. Line
4' R/S Coll. Line
(LM)348
IC 47
IC 46
IC 45
IC 44
+10V
-10V
Lower Keyboard Diapason Collector Line
Upper Keyboard Diapason Collector Line
Upper Keyb'd 8' R/S Coll. Line
IC 25
IC 24
IC 23
IC 22
GND
Orch. Clarinet, E. Piano, Vibes & Vibra Harp Coll. Line
16' R/S Coll Line

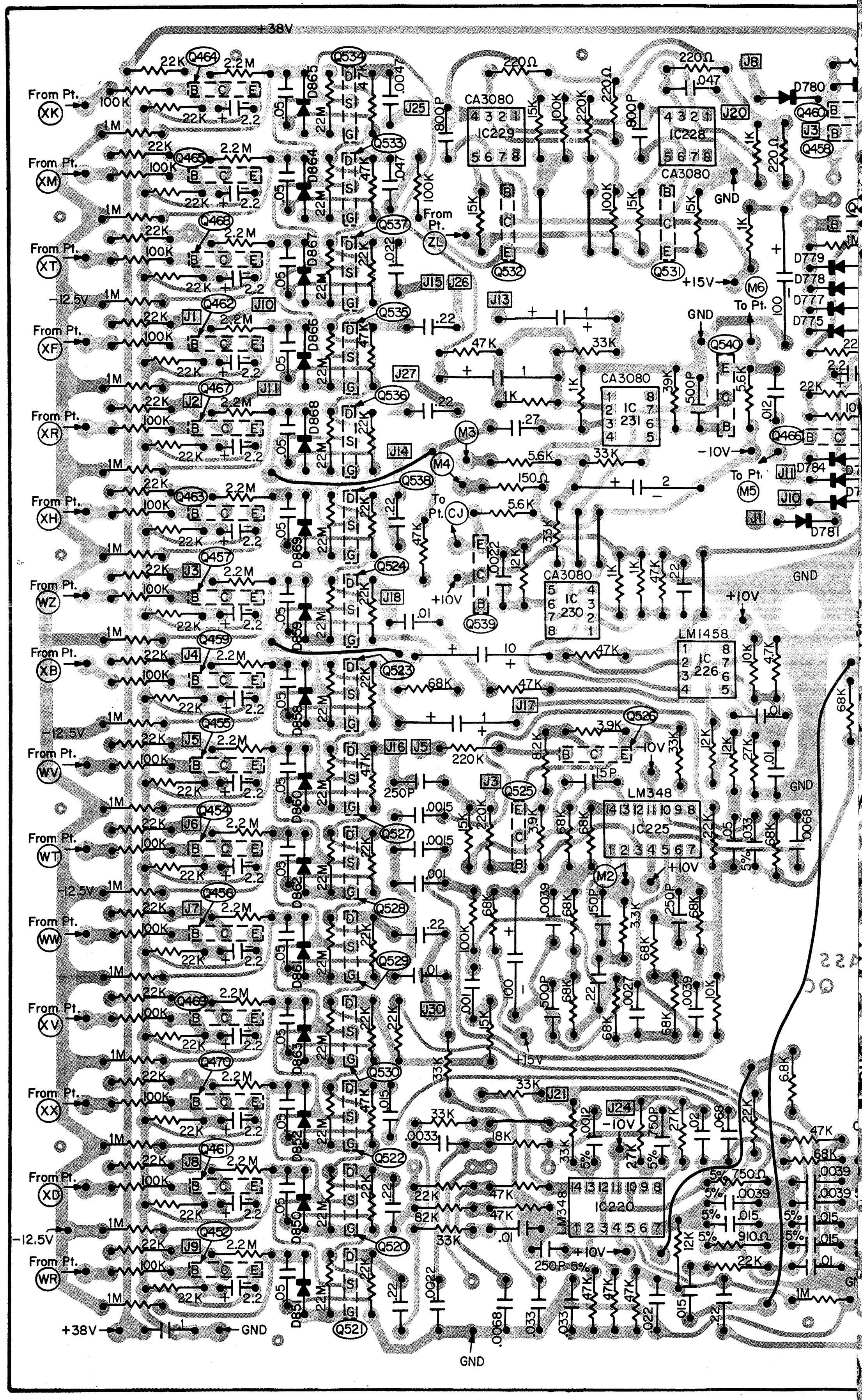
REED / STRING (


+15V
GND
+11V
-11V
From Pt.
To Pt.
CA3080
IC34
IC38
IC37
LM348
IC33
Q64
Q65
Q66
Q68
Q70
Q71
Q72
Q77
Q78
Q79
Q80
+18V

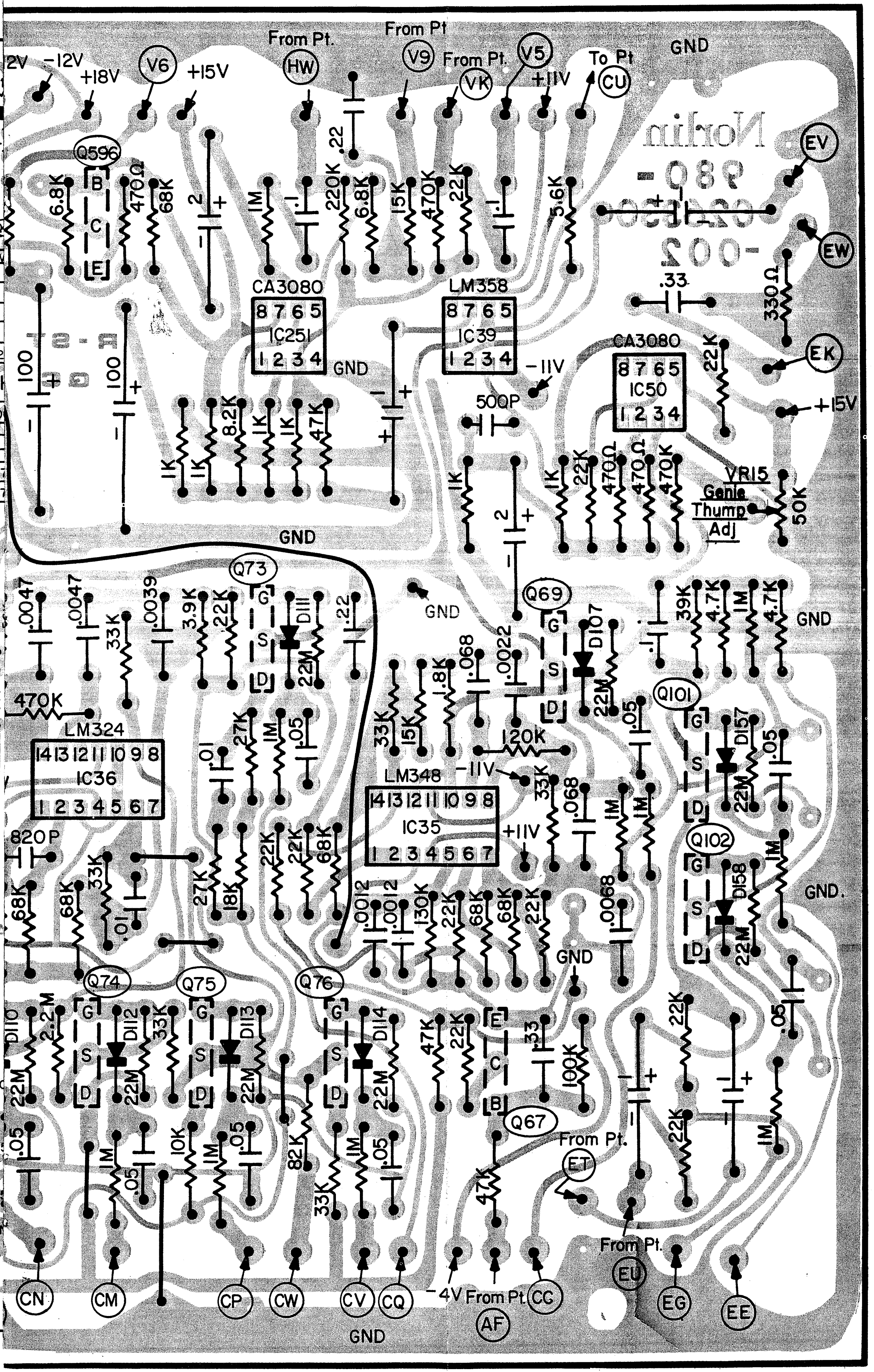
QUALITY CONTROL BOARD


Like J Nos. Indicate on Board Jumpers
Speed Adj.
Bias Adj
VR53
VR54
MN3002
IC235
LM348
IC234
IC227
IC224
IC223
IC222
IC221
IC219
IC218
+12V
-12V
+18V
+15V
+10V
-13V
+12.5V
980-026690-002
Norlin

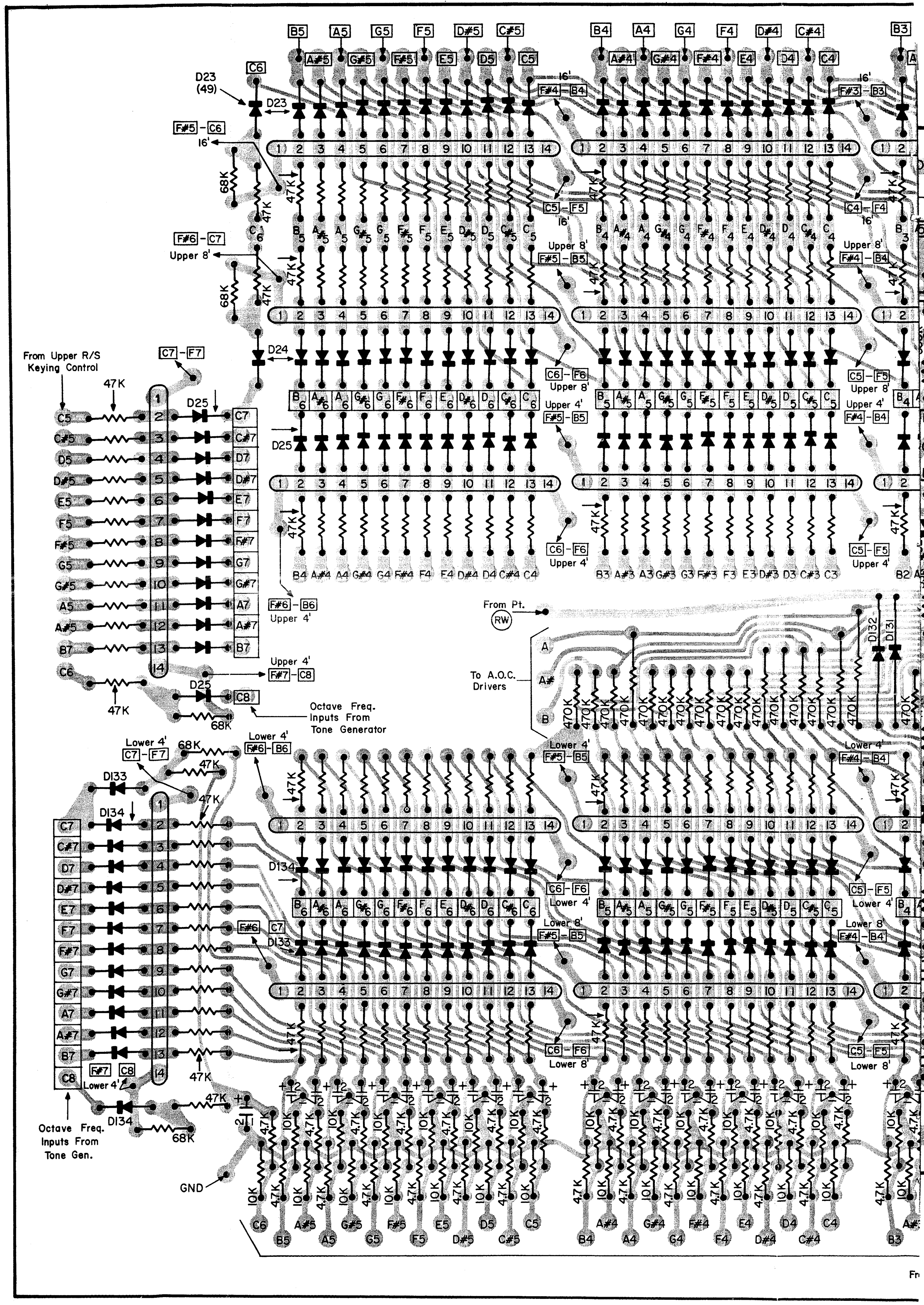
ORCHESTRAL SYMPHONIZER


+38V
From Pt. XK
From Pt. XM
From Pt. XT
From Pt. XF
From Pt. XR
From Pt. XH
From Pt. WZ
From Pt. XB
From Pt. WV
From Pt. WT
From Pt. WW
From Pt. XV
From Pt. XX
From Pt. XD
From Pt. WR
-12.5V
CA3080
IC229
IC228
IC 231
IC 230
LM1458
IC 226
LM348
IC225
IC220
From Pt. ZL
To Pt. M6
To Pt. M5
To Pt. CJ
+15V
-10V
+10V
GND
+38V
GND

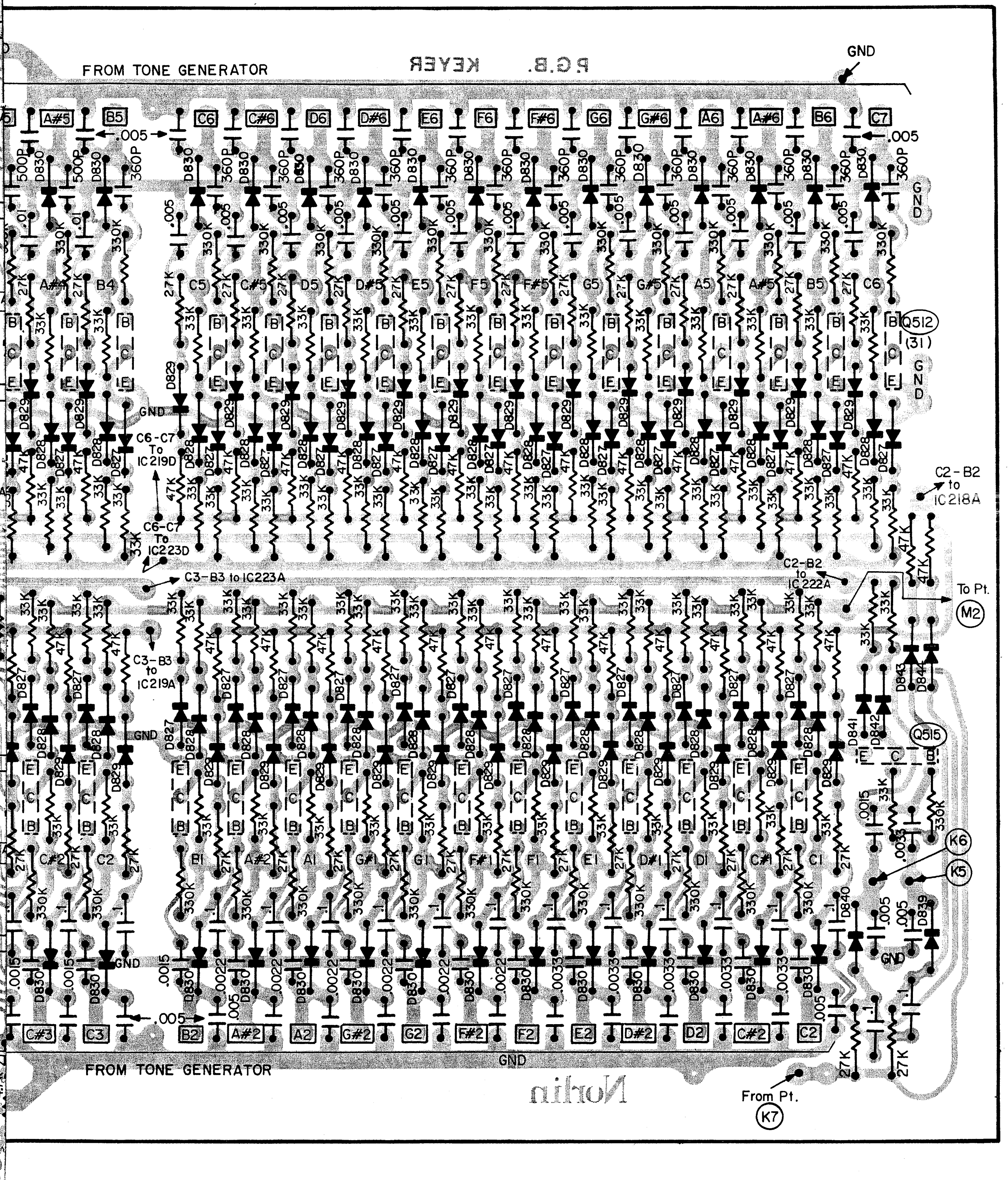
UALITY CONTROL BOARD


-12V
+18V
V6
+15V
From Pt. HW
From Pt V9
From Pt. VK
V5
+11V
To Pt CU
GND
EV
EW
EK
+15V
Q596
CA3080
IC251
LM358
IC39
-11V
500P
CA3080
IC50
VR15 Genie Thump Adj
50K
GND
Q73
Q69
Q101
Q102
LM324
IC36
LM348
IC35
+11V
GND.
Q74
Q75
Q76
Q67
From Pt. ET
From Pt. EU
CN
CM
CP
CW
CV
CQ
-4V
From Pt CC
AF
EG
EE
GND

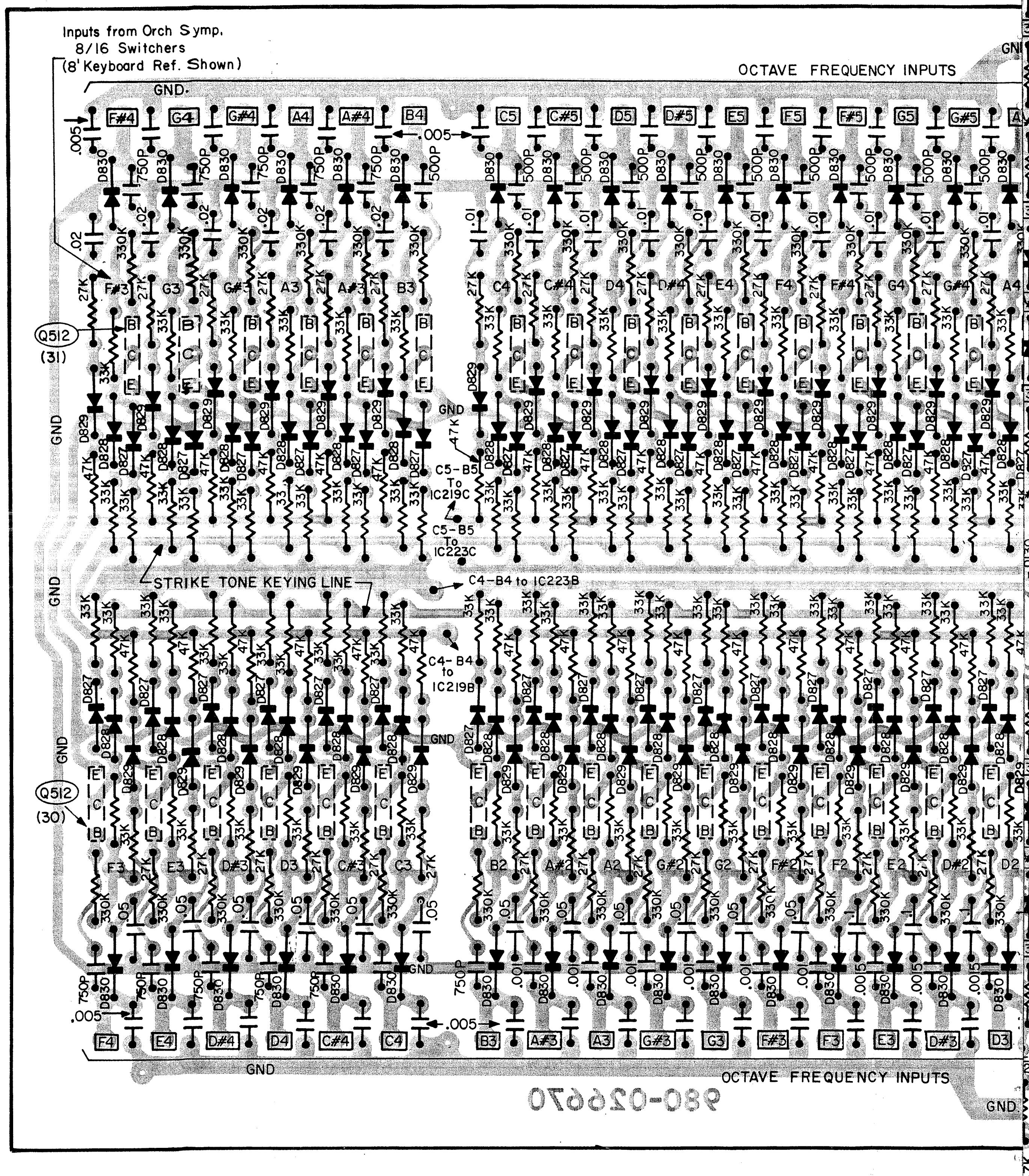
LOWER R/S KEYING CONTROL


From Upper R/S Keying Control
Octave Freq. Inputs From Tone Generator
From Pt. RW
To A.O.C. Drivers
Octave Freq. Inputs From Tone Gen.
GND
Upper 8'
Upper 4'
Lower 4'
Lower 8'
16'
D23 (49)
D24
D25
D133
D134
47K
68K

KEYER BOARD

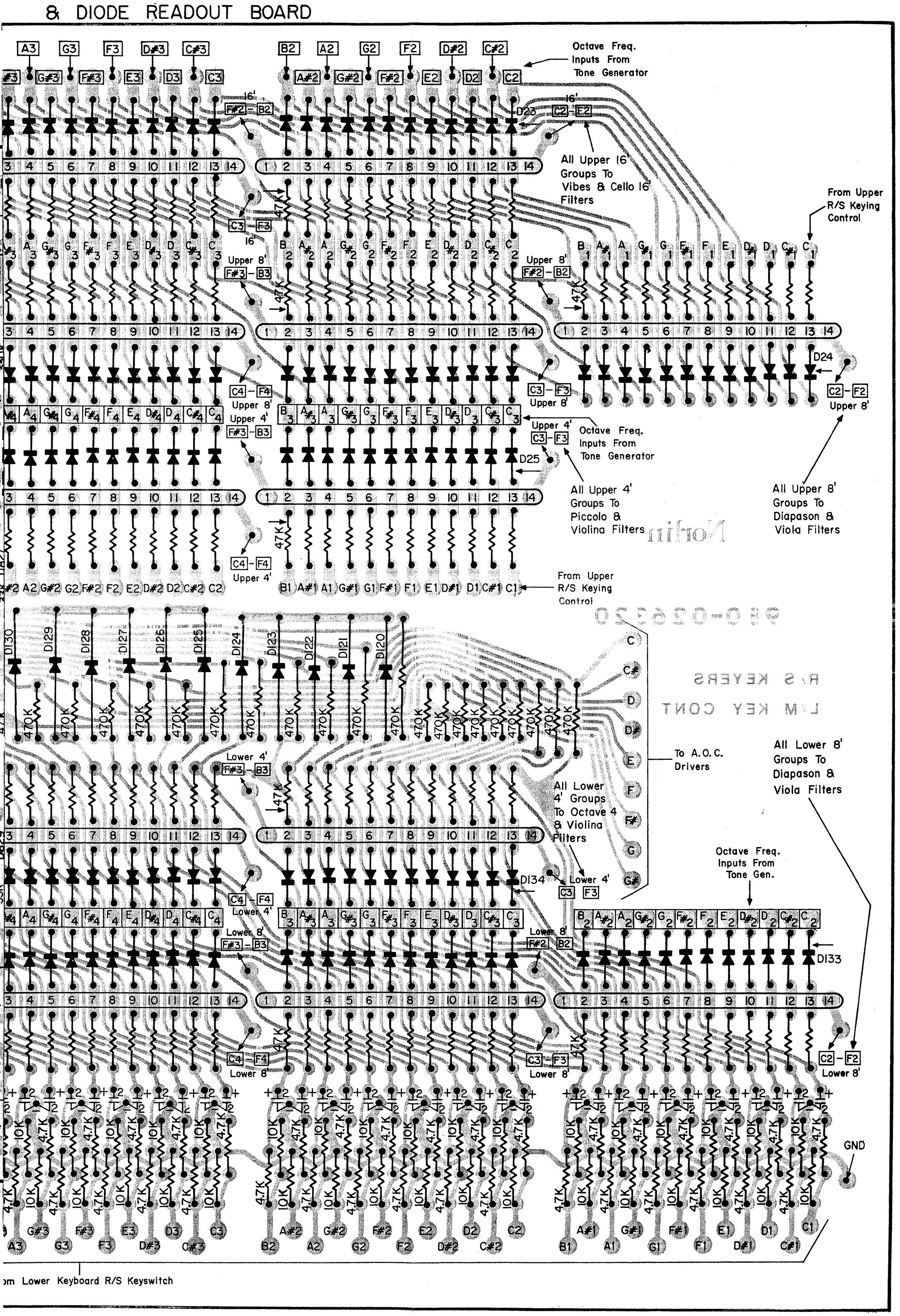

FROM TONE GENERATOR
GND
C6-C7 To IC219D
C6-C7 To IC223D
C3-B3 to IC223A
C2-B2 to IC218A
C2-B2 to IC222A
C3-B3 to IC219A
Q512 (31)
Q515
To Pt. M2
K6
K5
From Pt. K7
FROM TONE GENERATOR

ORCHESTRAL SYMPHONIZER



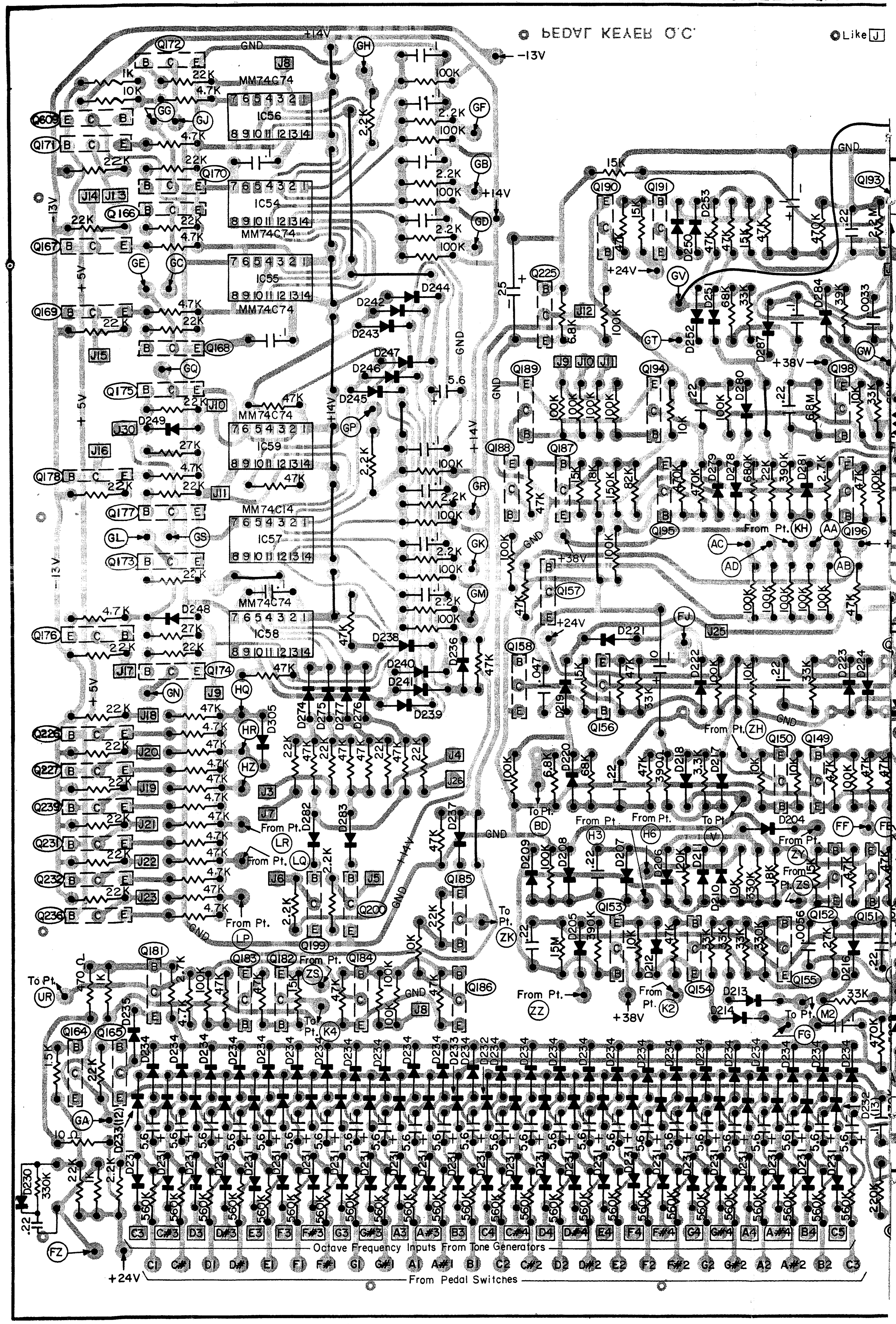
Inputs from Orch Symp. 8/16 Switchers (8' Keyboard Ref. Shown)
OCTAVE FREQUENCY INPUTS
GND.
F#4
G4
G#4
A4
A#4
B4
C5
C#5
D5
D#5
E5
F5
F#5
G5
G#5
.005
Q512 (31)
Q512 (30)
STRIKE TONE KEYING LINE
C5-B5 To IC219C
C5-B5 To IC223C
C4-B4 to IC223B
C4-B4 to IC219B
F4
E4
D#4
D4
C#4
C4
B3
A#3
A3
G#3
G3
F#3
F3
E3
D#3
D3
GND
980-026670

& DIODE READOUT BOARD

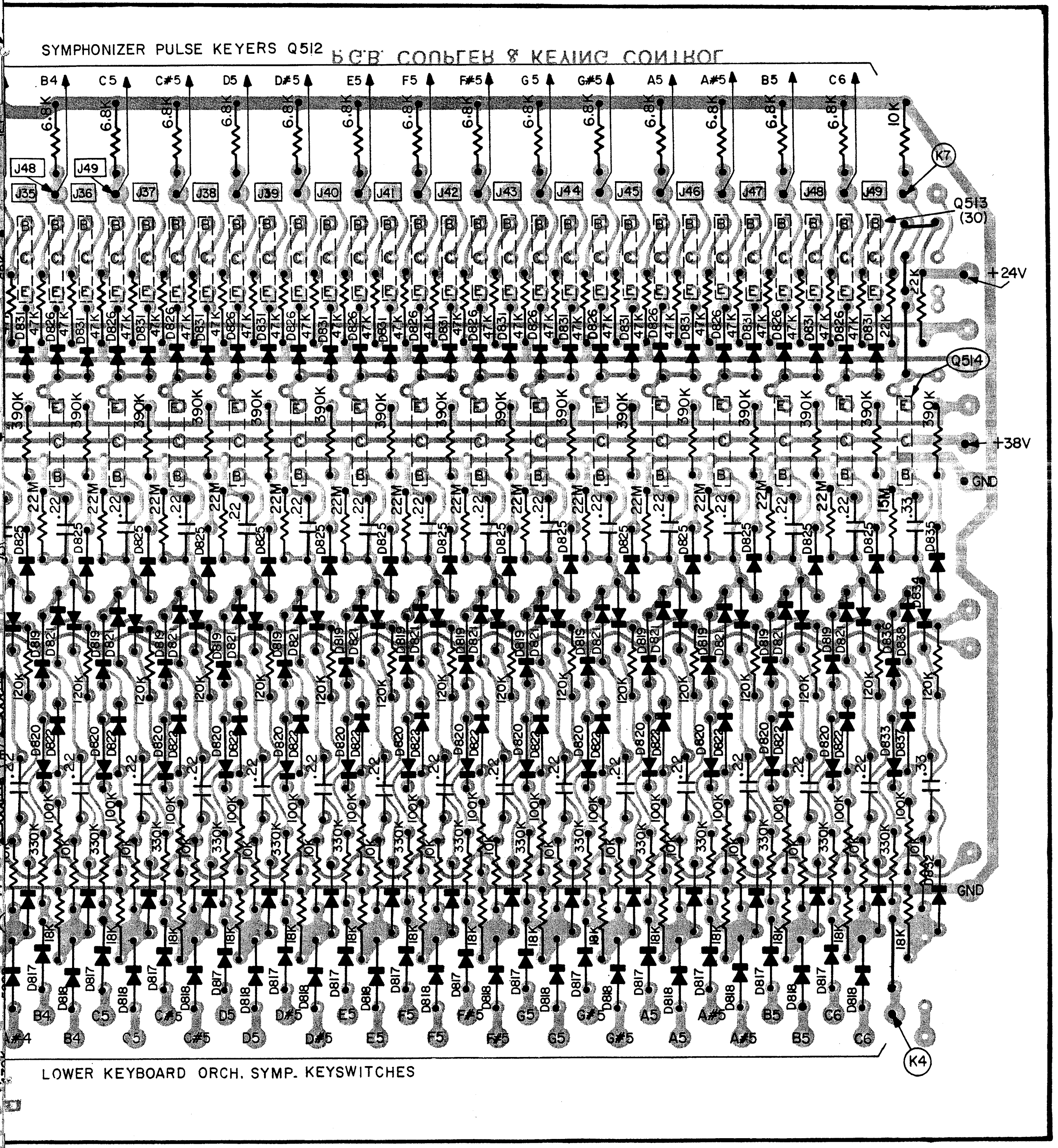


Octave Freq. Inputs From Tone Generator
All Upper 16' Groups To Vibes & Cello 16' Filters
From Upper R/S Keying Control
Upper 8'
Upper 4'
All Upper 4' Groups To Piccolo & Violina Filters
All Upper 8' Groups To Diapason & Viola Filters
980-026320
R/S KEYERS
L/M KEY CONT
To A.O.C. Drivers
All Lower 4' Groups To Octave 4 & Violina Filters
All Lower 8' Groups To Diapason & Viola Filters
Octave Freq. Inputs From Tone Gen.
Lower 4'
Lower 8'
GND
From Lower Keyboard R/S Keyswitch

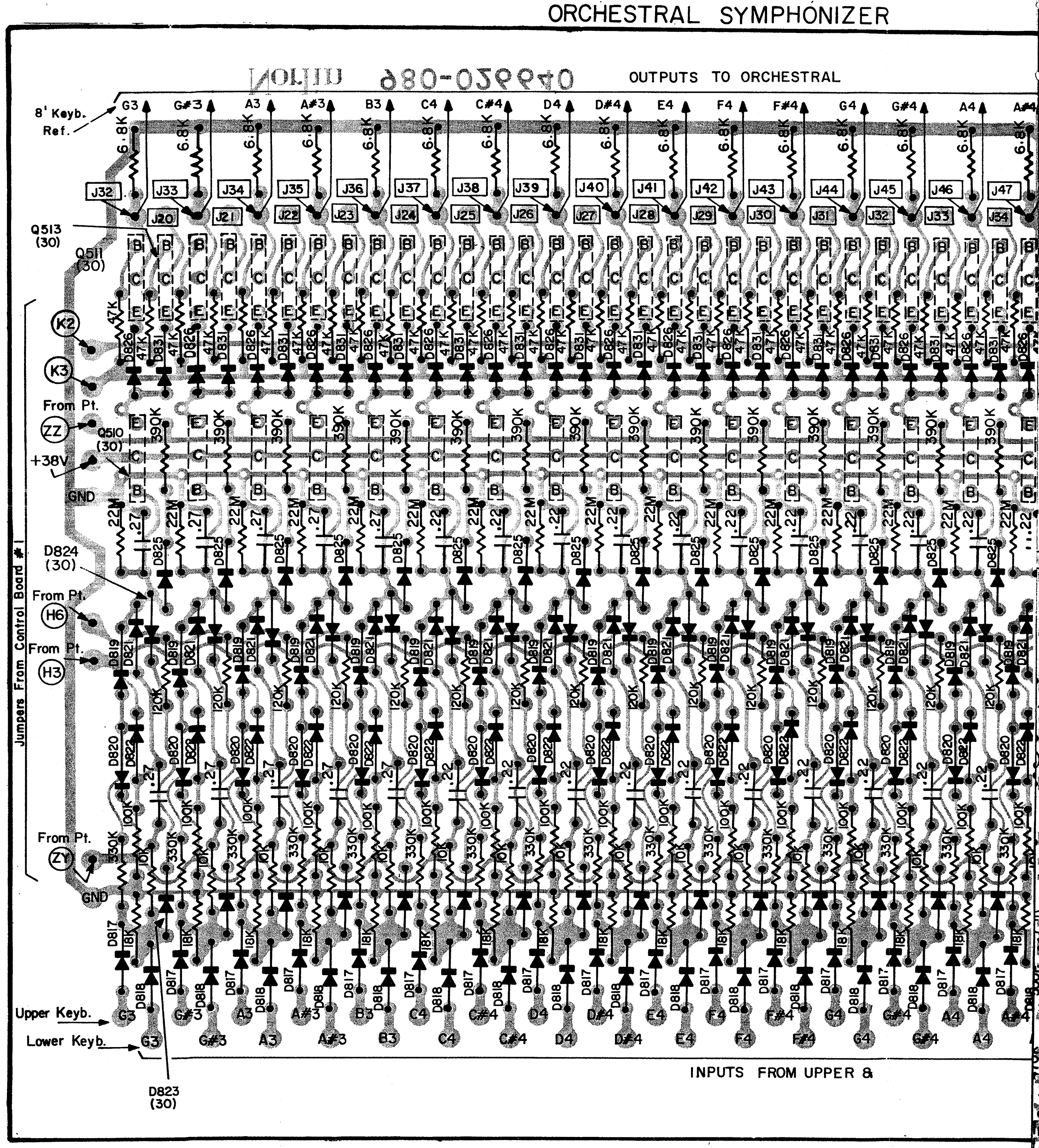
PEDAL SYMPHONIZER Q.C.


PEDAL KEYER Q.C.
Like J
IC54
IC55
IC56
IC57
IC58
IC59
MM74C74
MM74C14
+14V
-13V
+24V
+38V
GND
Octave Frequency Inputs From Tone Generators
From Pedal Switches

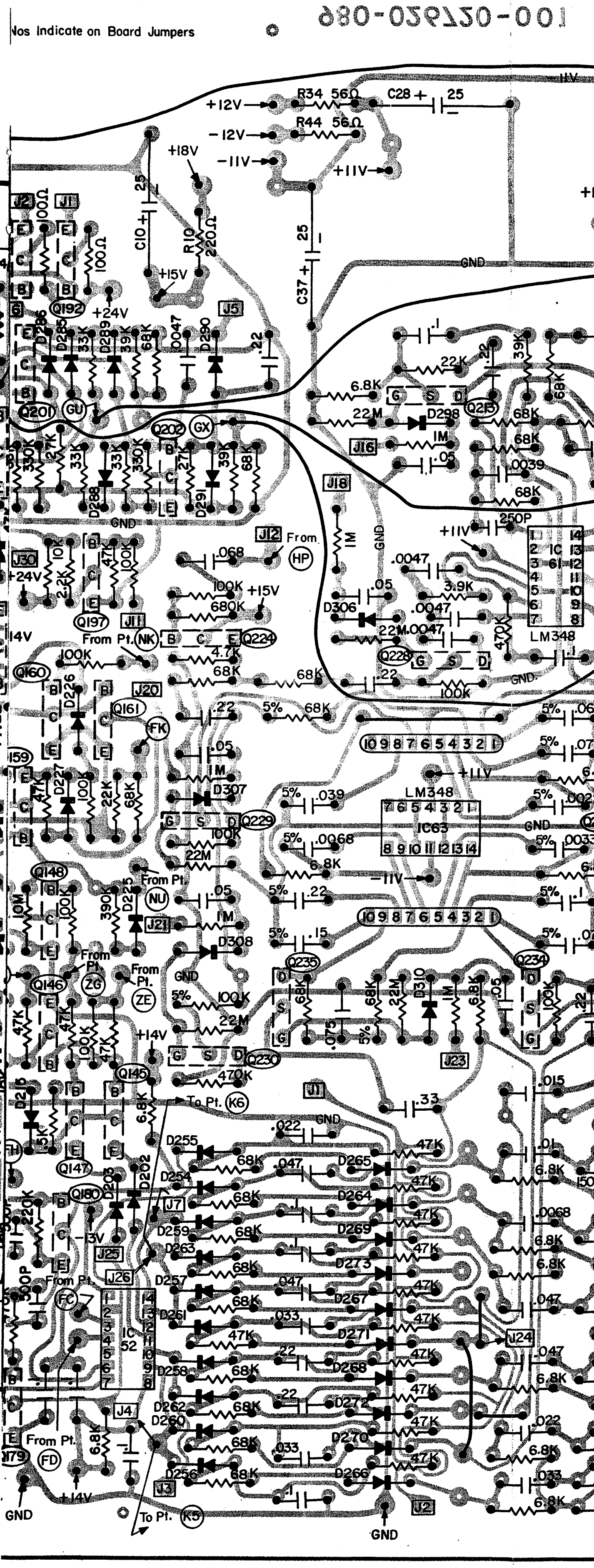
KEYING CONTROL BOARD 2


SYMPHONIZER PULSE KEYERS Q512
P.C.B. COUPLER & KEYING CONTROL
Q513 (30)
Q514
+24V
+38V
GND
LOWER KEYBOARD ORCH. SYMP. KEYSWITCHES

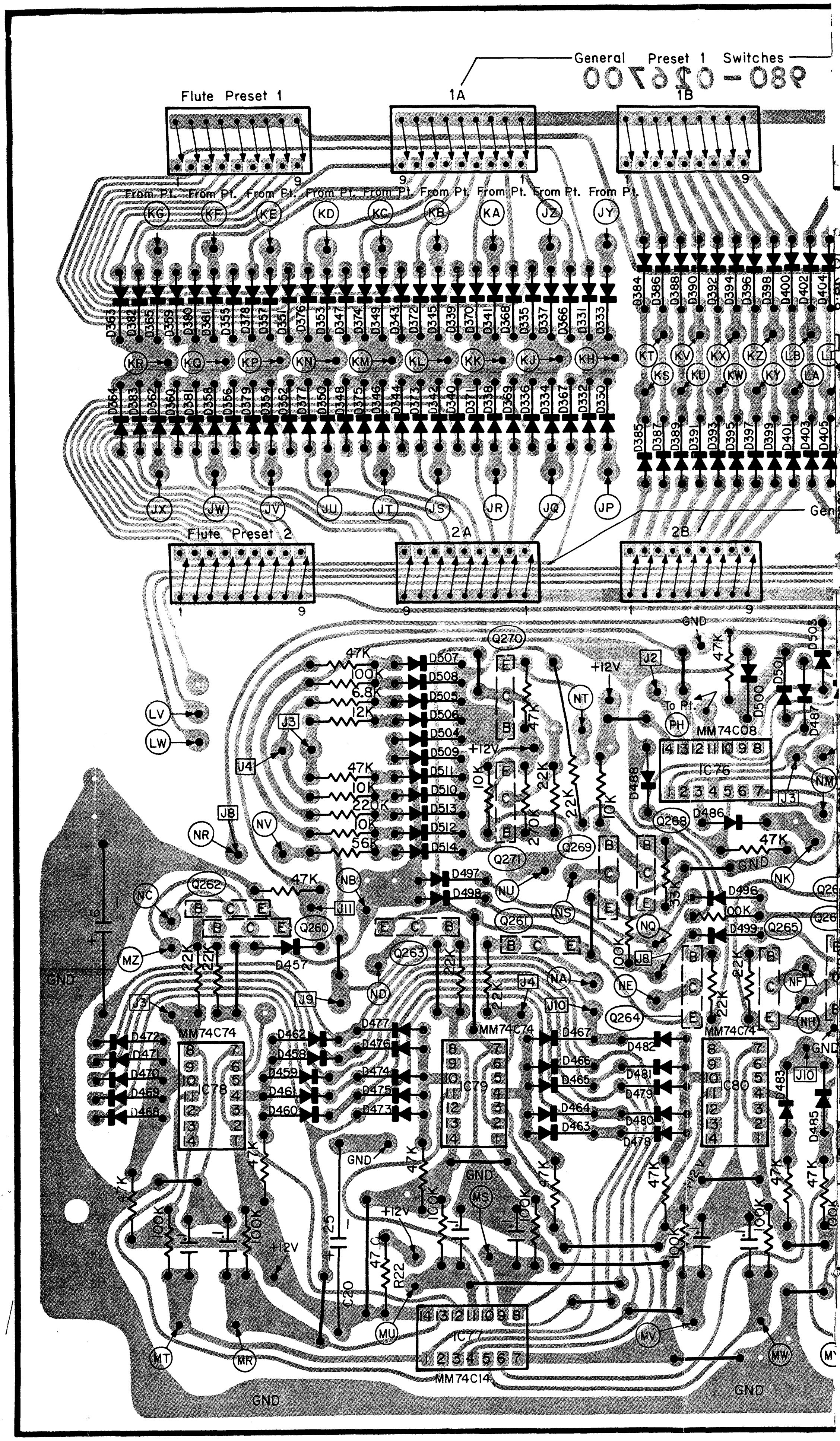
ORCHESTRAL SYMPHONIZER


OUTPUTS TO ORCHESTRAL
8' Keyb. Ref.
G3
G#3
A3
A#3
B3
C4
C#4
D4
D#4
E4
F4
F#4
G4
G#4
A4
Q513 (30)
Q511 (30)
Q510 (30)
From Pt. ZZ
+38V
GND
D824 (30)
From Pt. H6
From Pt. H3
From Pt. ZY
Jumpers From Control Board #1
Upper Keyb.
Lower Keyb.
D823 (30)
INPUTS FROM UPPER &

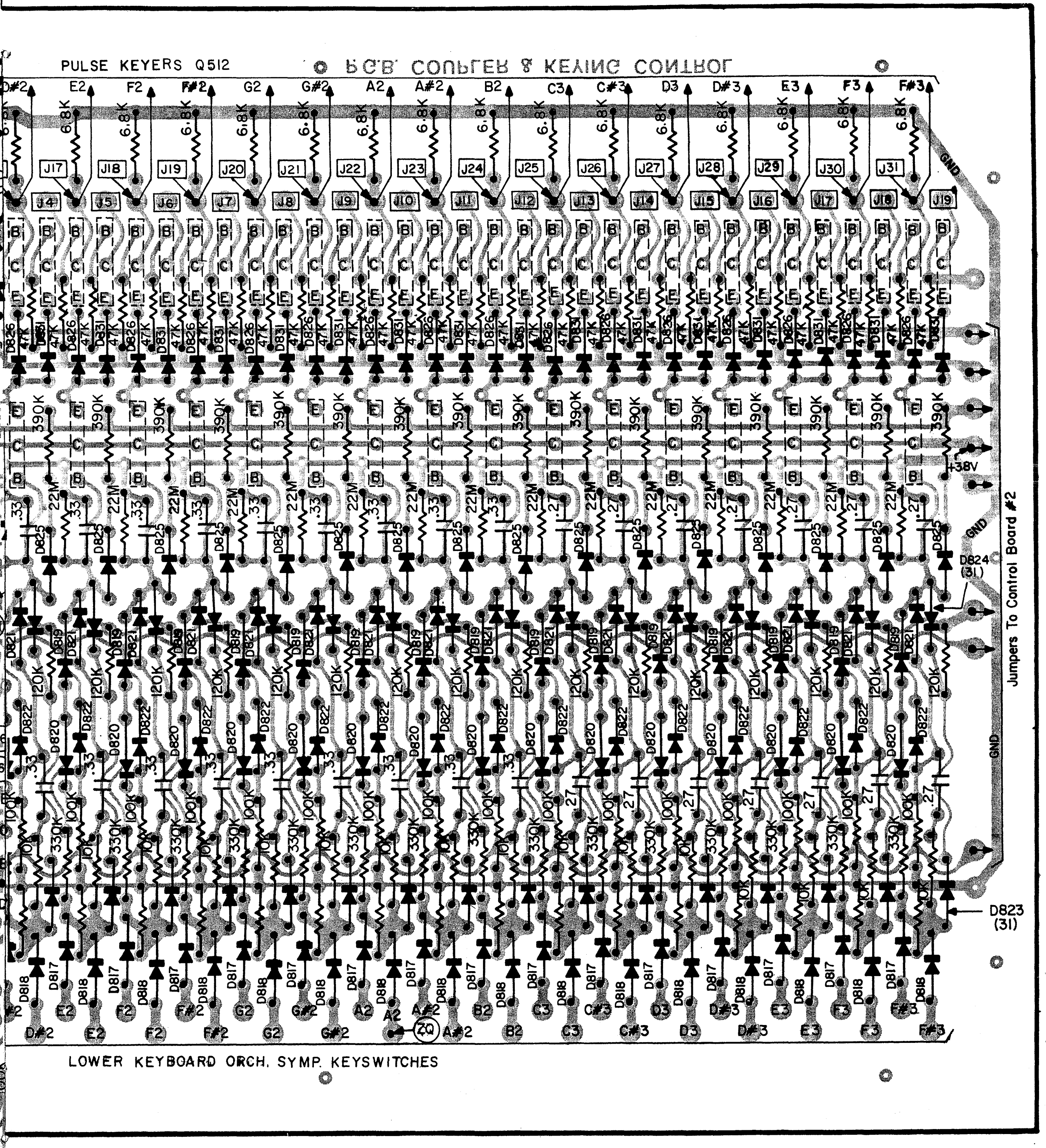
& CONTROL BOARD


Nos Indicate on Board Jumpers
+12V
-12V
+18V
-11V
+11V
+15V
+24V
GND
LM348
IC 62
IC 63
IC 64
IC 65
IC 52
CA3080
From Pt. HP
From Pt. NK
From Pt. NU
From Pt. ZG
From Pt. ZE
To Pt. K6
From Pt. FC
From Pt. FD
To Pt. K5
+14V
-4V
HS
HT
HU
HV
HW
HX

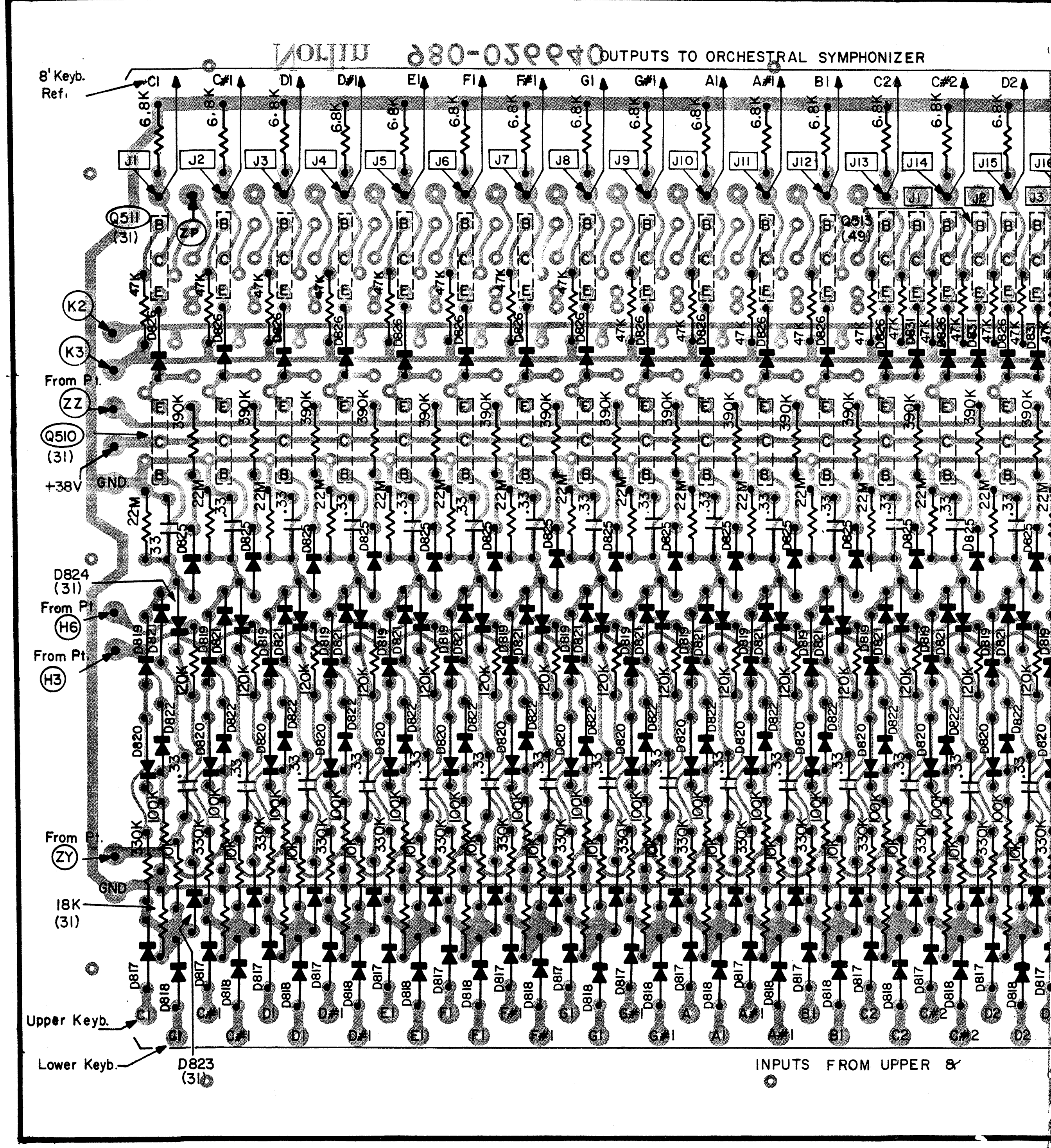
FLUTE & GENERAL


General Preset 1 Switches
980-026700
Flute Preset 1
1A
1B
From Pt.
KG
KF
KE
KD
KC
KB
KA
JZ
JY
Flute Preset 2
2A
2B
JX
JW
JV
JU
JT
JS
JR
JQ
JP
MM74C08
IC76
MM74C74
IC78
IC79
IC80
MM74C14
IC77
+12V
GND
To Pt.
PH
LV
LW
NR
NV
NC
MZ
MT
MR
MU
MS
MV
MW

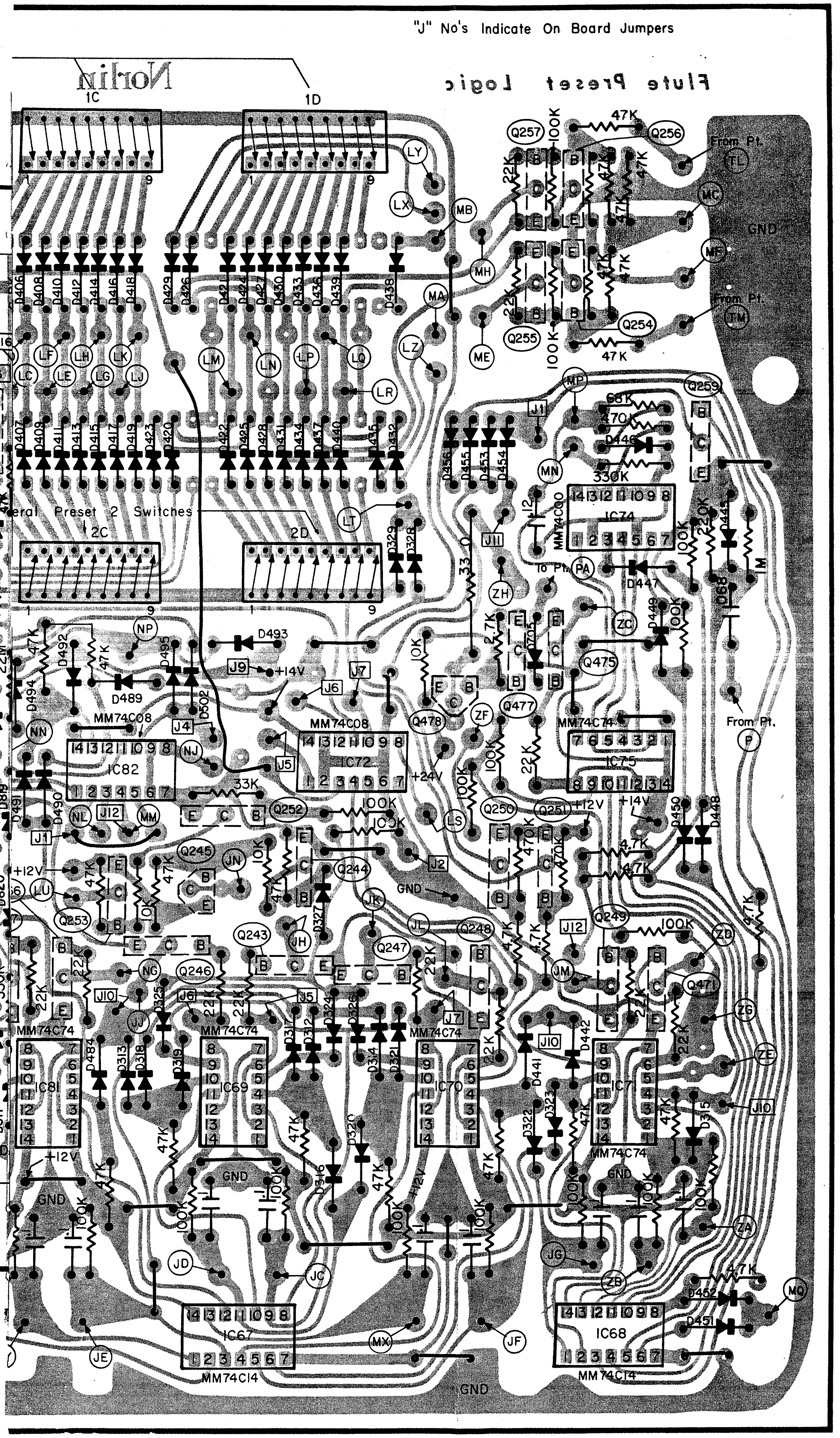
CONTROL BOARD 1


PULSE KEYERS Q512
P.C.B. COUPLER & KEYING CONTROL
D#2
E2
F2
F#2
G2
G#2
A2
A#2
B2
C3
C#3
D3
D#3
E3
F3
F#3
6.8K
47K
390K
22M
120K
100K
330K
+38V
GND
D824 (31)
D823 (31)
Jumpers To Control Board #2
ZQ
LOWER KEYBOARD ORCH. SYMP. KEYSWITCHES

ORCHESTRAL SYMPHONIZER KEYING

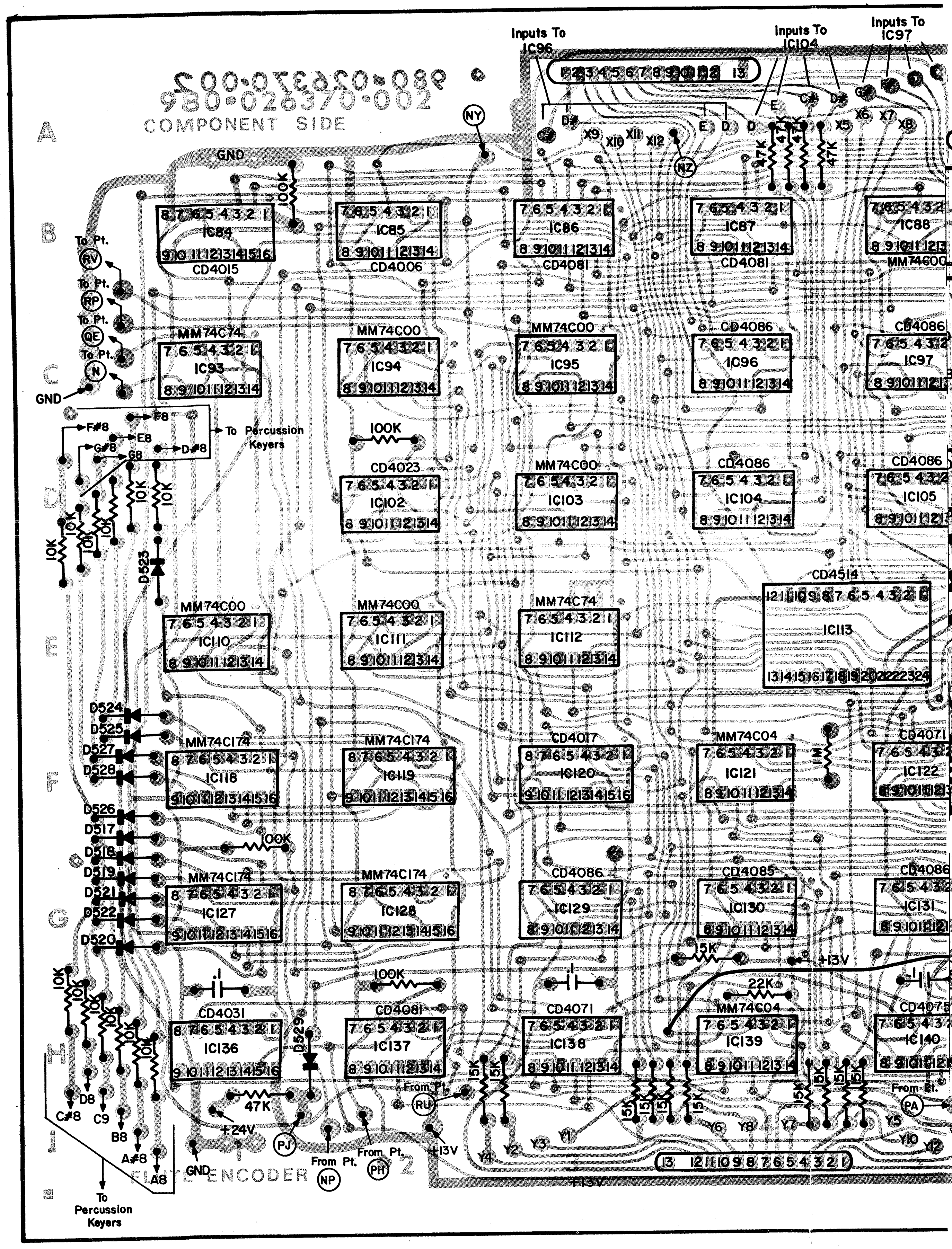

Norlin
049920-086
OUTPUTS TO ORCHESTRAL SYMPHONIZER
8' Keyb. Ref.
C1 C#1 D1 D#1 E1 F1 F#1 G1 G#1 A1 A#1 B1 C2 C#2 D2
6.8K
J1 J2 J3 J4 J5 J6 J7 J8 J9 J10 J11 J12 J13 J14 J15 J16
Q511 (31)
ZP
Q513 (49)
47K
390K
22M
.33
120K
100K
330K
10K
D817 D818 D819 D820 D821 D822 D825 D826 D831
K2
K3
From Pt.
ZZ
Q510 (31)
+38V
GND
D824 (31)
From Pt.
H6
From Pt.
H3
From Pt.
ZY
GND
18K (31)
Upper Keyb.
Lower Keyb.
D823 (31)
INPUTS FROM UPPER &

PRESET BOARD


"J" No's Indicate On Board Jumpers

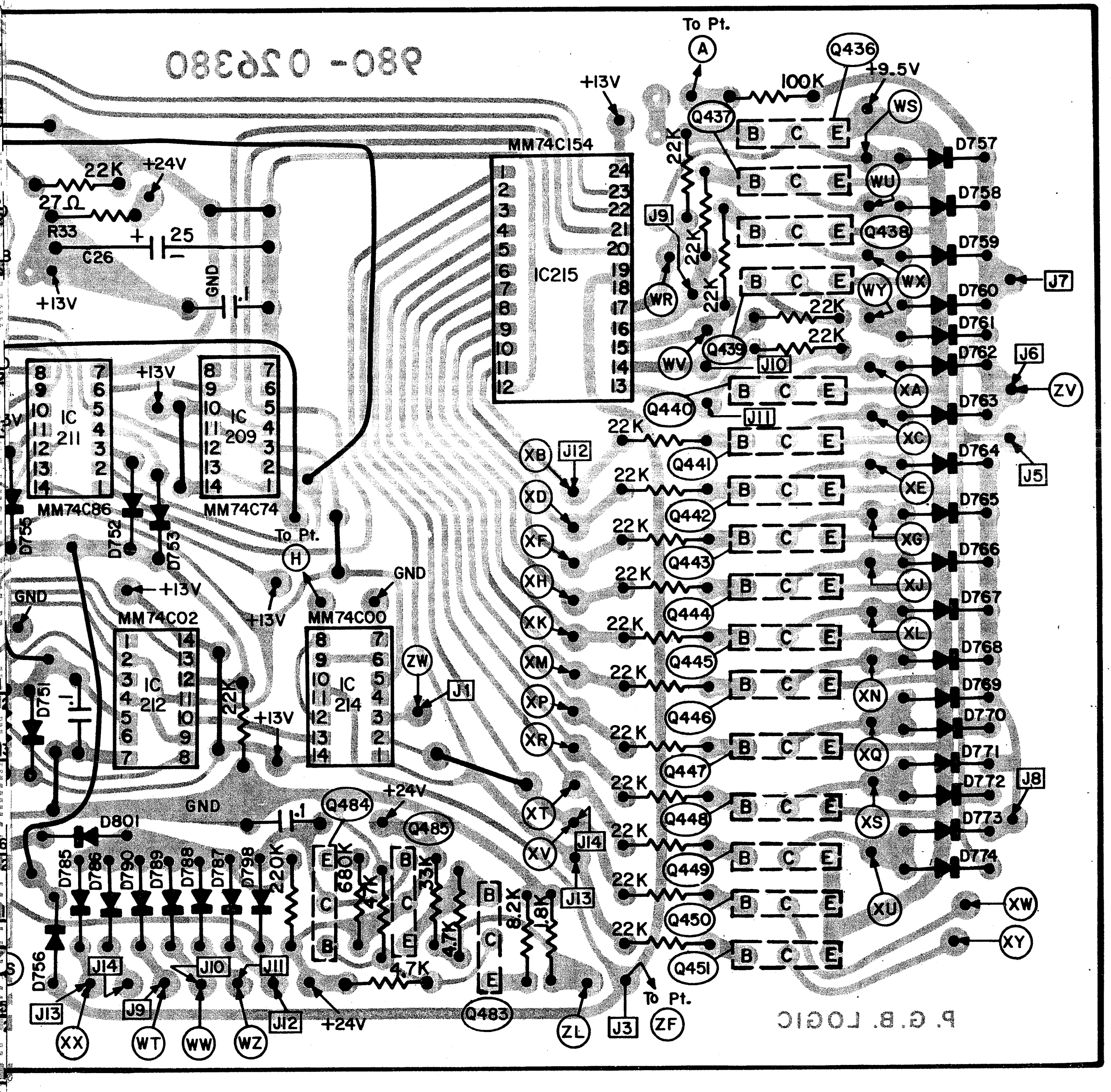
Norlin
Flute Preset Logic
1C
1D
eral Preset 2 Switches
2C
2D
LY LX MB MH MA ME LZ LR LO LP LN LM LK LJ LH LG LF LE LC LT
Q257 Q256 Q255 Q254 Q259
From Pt. TL
MC
MF
From Pt. TM
GND
MP MN
IC74 MM74C00
To Pt. PA
D446 D447
ZH ZC
Q475 Q477 Q478
ZF
From Pt. P
IC75 MM74C74
IC72 MM74C08
IC82 MM74C08
NP NN NJ NE NM NG
D489 D493
+14V +12V +24V
Q250 Q251 Q252 Q253
Q243 Q244 Q245 Q246 Q247 Q248 Q249
JN JK JL JH JM JJ
LS LU
ZD Q471 Z6 ZE J10 ZA
IC81 MM74C74
IC69 MM74C74
IC70 MM74C74
IC71 MM74C74
GND
JD JC JE JF JG ZB
MX
IC67 MM74C14
IC68 MM74C14
MQ
D451 D452
GND

FLUTE & PERCUSSION

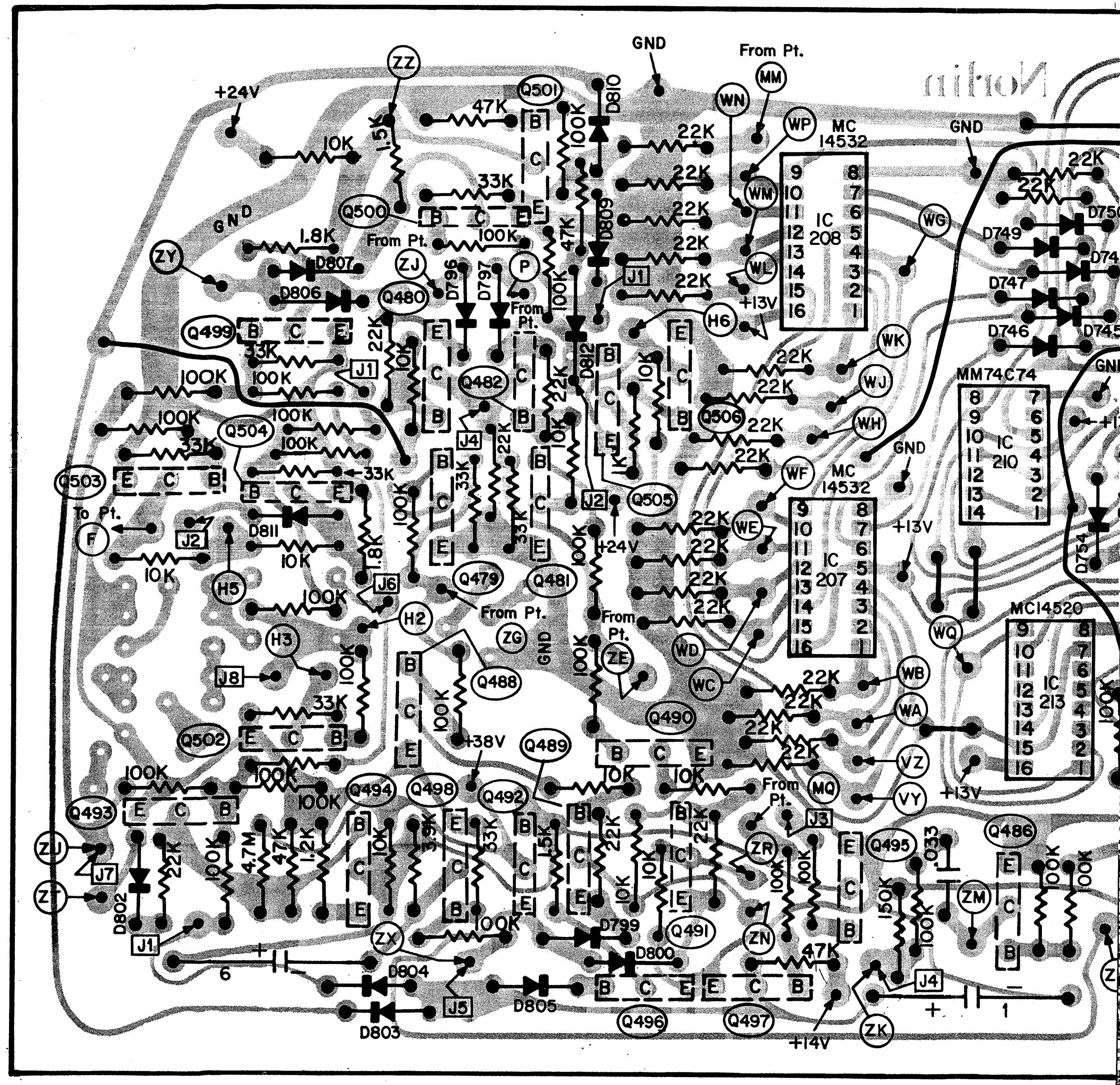

980-026370-002
COMPONENT SIDE
Inputs To IC96
Inputs To IC104
Inputs To IC97
A
B
C
D
E
F
G
H
J
GND
To Pt. RV
To Pt. RP
To Pt. QE
To Pt. N
NY
NZ
X5
X6
X7
X8
X9
X10
X11
X12
IC84 CD4015
IC85 CD4006
IC86 CD4081
IC87 CD4081
IC88 MM74C00
IC93 MM74C74
IC94 MM74C00
IC95 MM74C00
IC96 CD4086
IC97 CD4086
To Percussion Keyers
F#8
E8
G#8
G8
D#8
F8
IC102 CD4023
IC103 MM74C00
IC104 CD4086
IC105 CD4086
IC113 CD4514
D523
IC110 MM74C00
IC111 MM74C00
IC112 MM74C74
D524
D525
D527
D528
D526
D517
D518
D519
D521
D522
D520
IC118 MM74C174
IC119 MM74C174
IC120 CD4017
IC121 MM74C04
IC122
IC127 MM74C174
IC128 MM74C174
IC129 CD4086
IC130 CD4085
IC131 CD4086
IC136 CD4031
IC137 CD4081
IC138 CD4071
IC139 MM74C04
IC140 CD4075
D529
100K
47K
22K
15K
10K
+13V
+24V
From Pt. RU
From Pt. NP
From Pt. PH
From Pt. PA
PJ
Y1
Y2
Y3
Y4
Y5
Y6
Y7
Y8
Y10
Y12
D8
C#8
C9
B8
A#8
A8
FLUTE ENCODER
To Percussion Keyers

ONIZER LATCH BD.

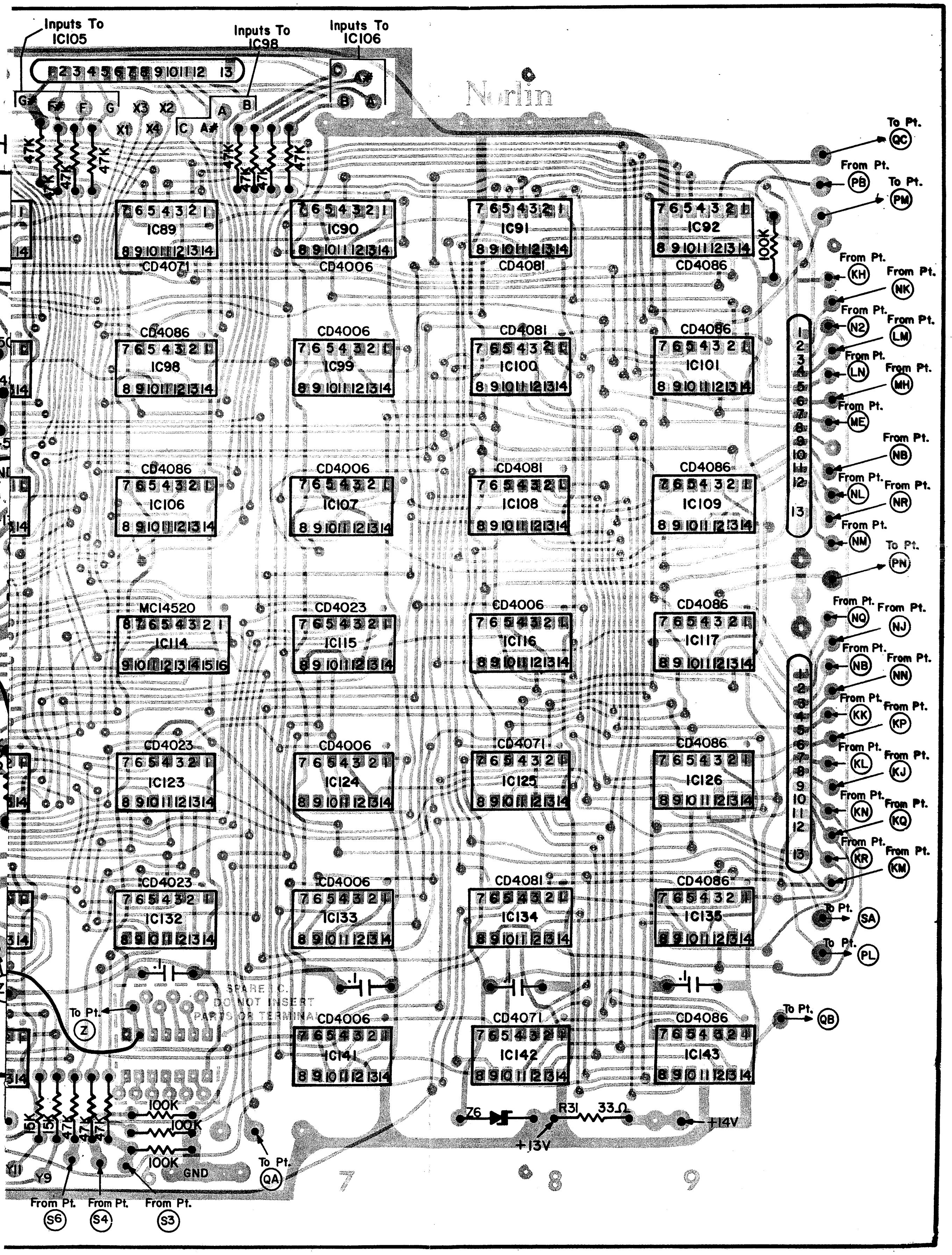
Like J No's Indicate On Board Jumpers


980-026380
To Pt. A
Q436
+9.5V
100K
+13V
+24V
22K
27Ω
R33
C26
25
IC215 MM74C154
IC 211 MM74C86
IC 209 MM74C74
IC 212 MM74C02
IC 214 MM74C00
To Pt. H
GND
D750
D751
D752
D753
D757
D758
D759
D760
D761
D762
D763
D764
D765
D766
D767
D768
D769
D770
D771
D772
D773
D774
D785
D786
D787
D788
D789
D790
D798
D801
D756
Q437
Q438
Q439
Q440
Q441
Q442
Q443
Q444
Q445
Q446
Q447
Q448
Q449
Q450
Q451
Q483
Q484
Q485
B C E
WS
WU
WX
WY
WR
WV
XA
XB
XC
XD
XE
XF
XG
XH
XJ
XK
XL
XM
XN
XP
XQ
XR
XS
XT
XU
XV
XW
XY
XX
WT
WW
WZ
ZL
ZV
ZW
To Pt. ZF
J1
J3
J5
J6
J7
J8
J9
J10
J11
J12
J13
J14
680K
220K
33K
47K
4.7K
8.2K
1.8K
P. G. B. LOGIC

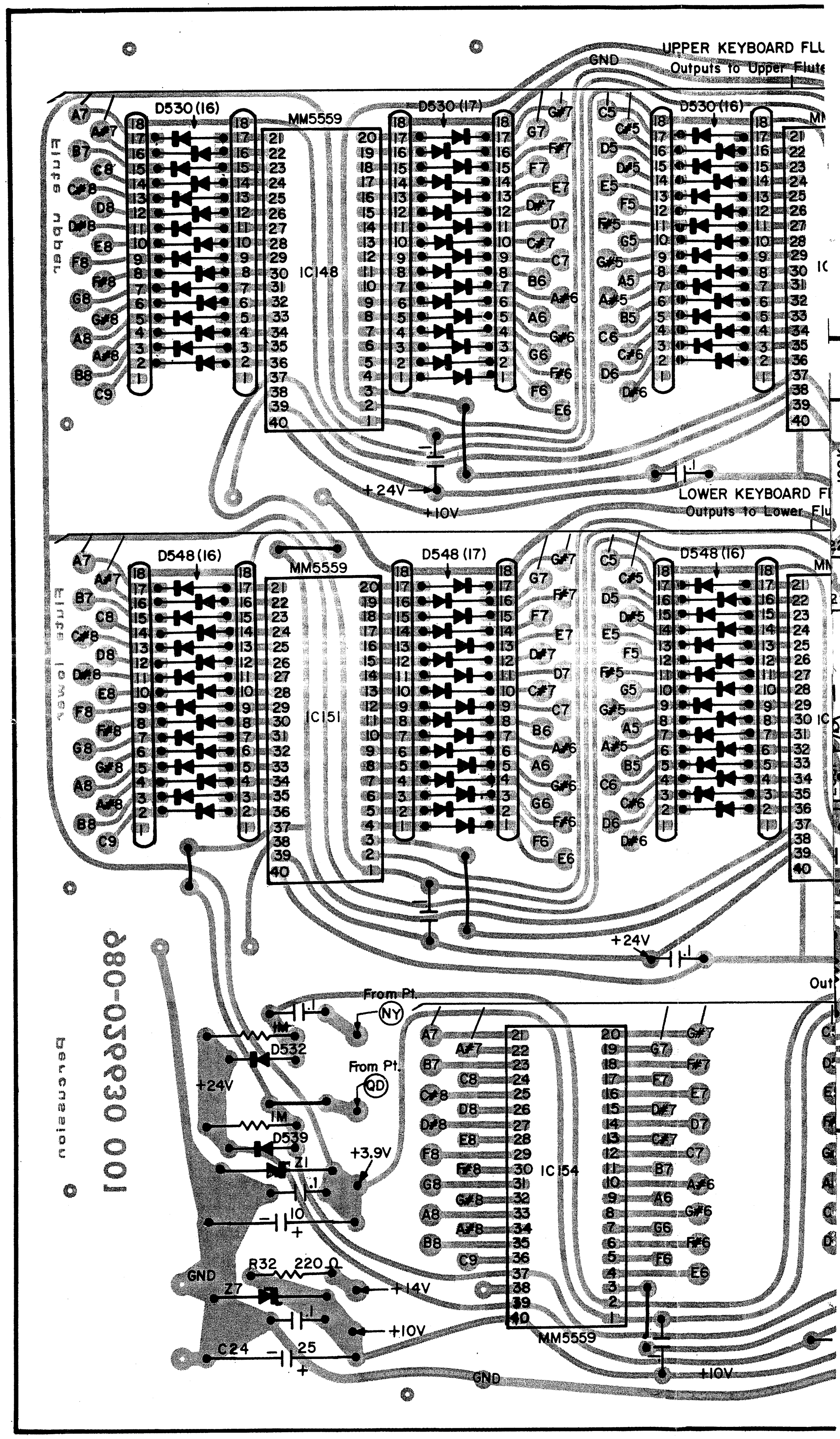
ORCHESTRAL SYMPH


+24V
GND
10K
15K
47K
Q501
D810
100K
22K
From Pt.
MM
WN
WP
MC 14532
IC 208
ZZ
Q500
33K
From Pt.
ZJ
P
D796
D797
D809
J1
WM
WL
+13V
WG
H6
ZY
1.8K
D807
D806
Q480
Q499
Q504
Q482
J4
Q506
WK
WJ
WH
MM74C74
IC 210
D749
D750
D747
D746
D745
D754
Q503
To Pt.
F
J2
D811
H5
J6
H2
Q479
Q481
Q505
ZG
ZE
WF
WE
MC 14532
IC 207
WD
WC
Q488
H3
J8
Q502
Q490
+38V
Q489
WB
WA
VZ
VY
MQ
WQ
MC14520
IC 213
Q493
ZU
ZT
J7
D802
4.7M
1.2K
Q494
Q498
Q492
J3
Q495
.033
Q486
ZM
ZR
ZN
ZX
D804
D803
J5
D805
D799
D800
Q491
Q496
Q497
+14V
ZK
6
1
Norlin

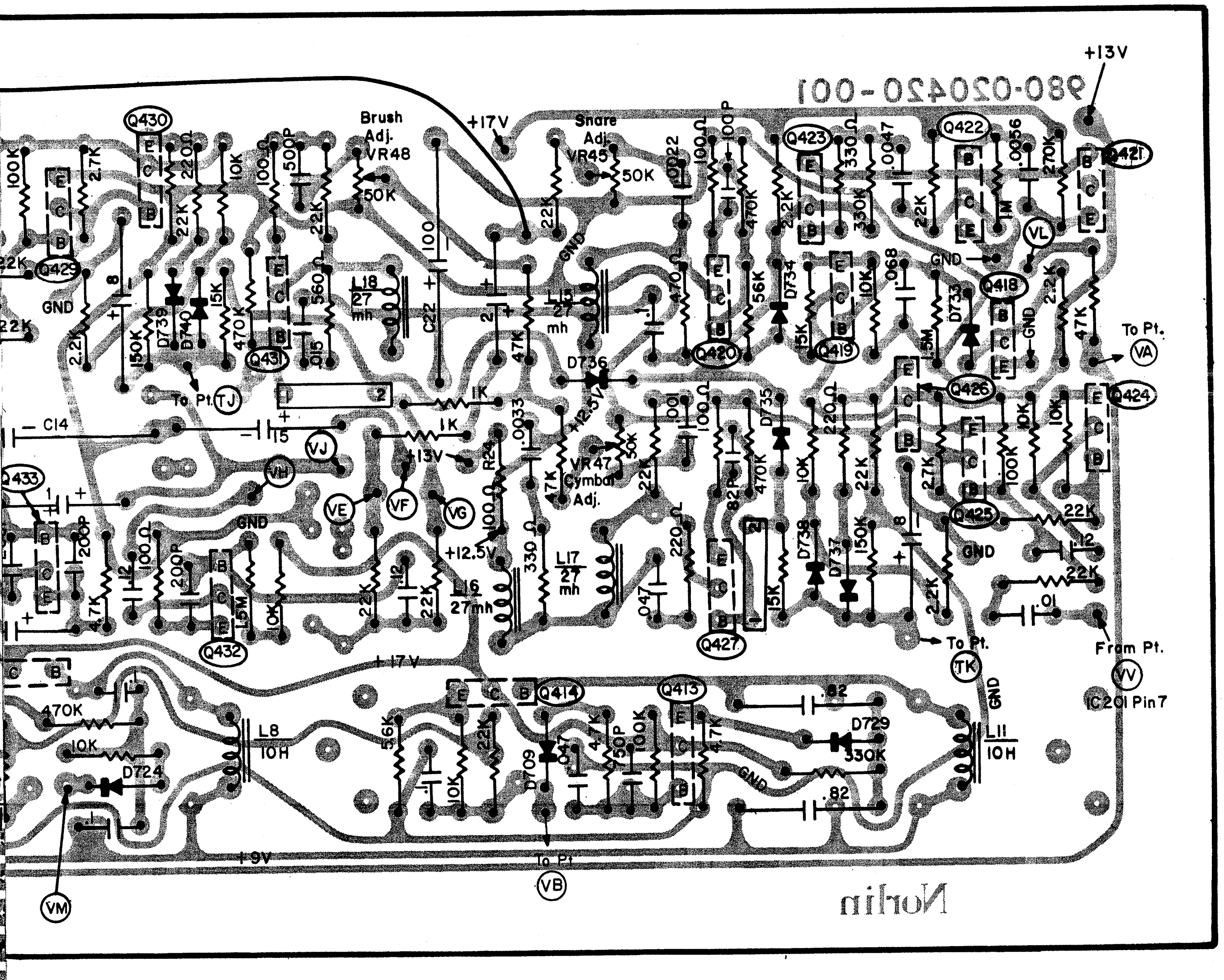
ENCODER BOARD


Inputs To IC105
Inputs To IC98
Inputs To IC106
Norlin
47K
CD4071 IC89
CD4006 IC90
CD4081 IC91
CD4086 IC92
CD4086 IC98
CD4006 IC99
CD4081 IC100
CD4086 IC101
CD4086 IC106
CD4006 IC107
CD4081 IC108
CD4086 IC109
MC14520 IC114
CD4023 IC115
CD4006 IC116
CD4086 IC117
CD4023 IC123
CD4006 IC124
CD4071 IC125
CD4086 IC126
CD4023 IC132
CD4006 IC133
CD4081 IC134
CD4086 IC135
CD4006 IC141
CD4071 IC142
CD4086 IC143
To Pt. QC
From Pt. PB
To Pt. PM
From Pt. KH
From Pt. NK
From Pt. N2
From Pt. LM
From Pt. LN
From Pt. MH
From Pt. ME
From Pt. NB
From Pt. NL
From Pt. NR
From Pt. NM
To Pt. PN
From Pt. NQ
From Pt. NJ
From Pt. NB
From Pt. NN
From Pt. KK
From Pt. KP
From Pt. KL
From Pt. KJ
From Pt. KN
From Pt. KQ
From Pt. KR
From Pt. KM
To Pt. SA
To Pt. PL
To Pt. QB
To Pt. Z
SPARE I.C. DO NOT INSERT PARTS OR TERMINALS
100K
15K
Y9
GND
To Pt. QA
From Pt. S6
From Pt. S4
From Pt. S3
Z6
R31 33Ω
+13V
+14V
7
8
9

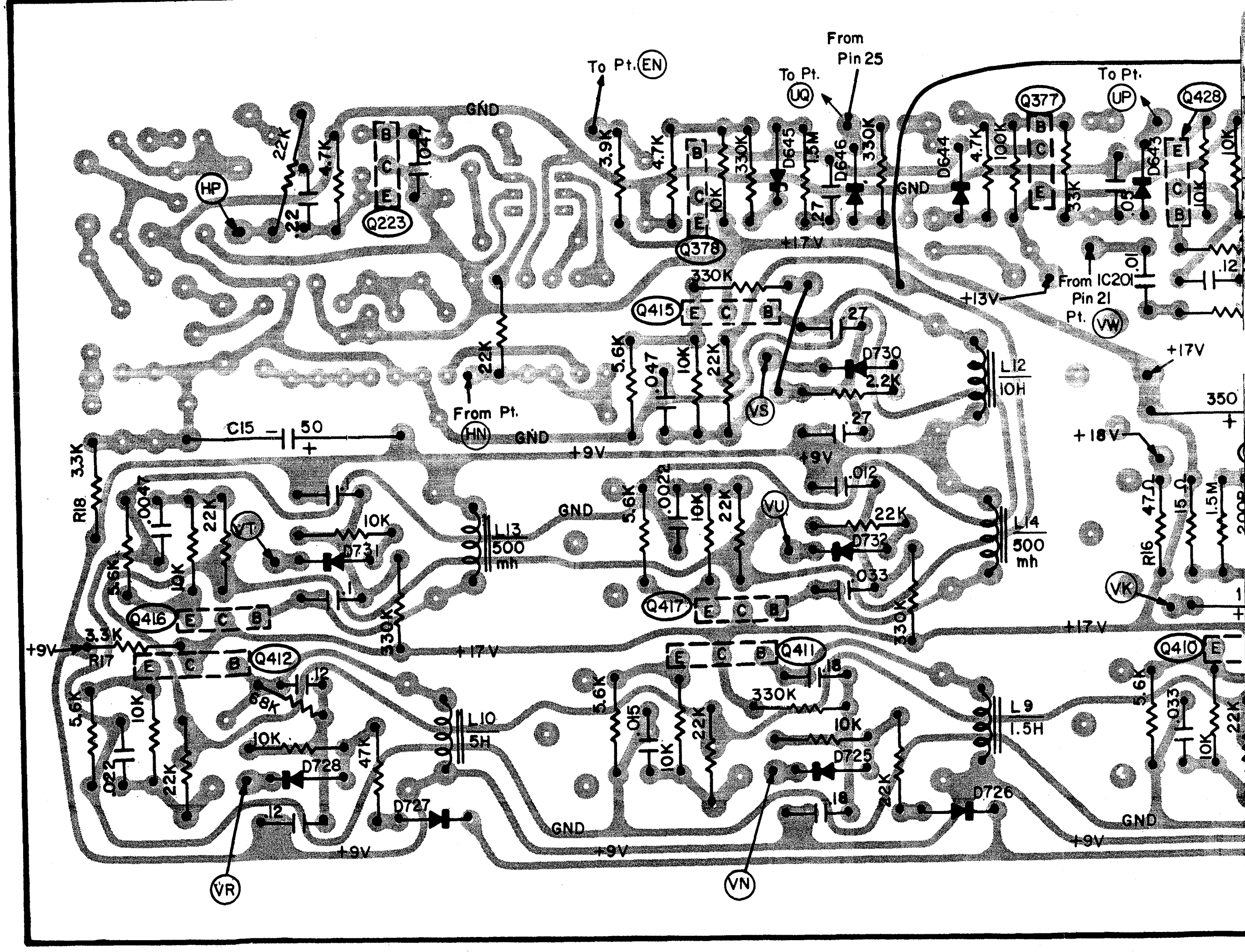
FLUTE & PERCUSSIC


UPPER KEYBOARD FLU
Outputs to Upper Flute
LOWER KEYBOARD FL
Outputs to Lower Flu
GND
D530 (16)
D530 (17)
MM5559
IC148
IC151
IC154
D548 (16)
D548 (17)
Flute upper
Flute lower
+24V
+10V
+14V
+3.9V
From Pt. NY
From Pt. QD
D532
D539
Z1
Z7
R32 220 Ω
C24 25
1M
980-02630 001
percussion

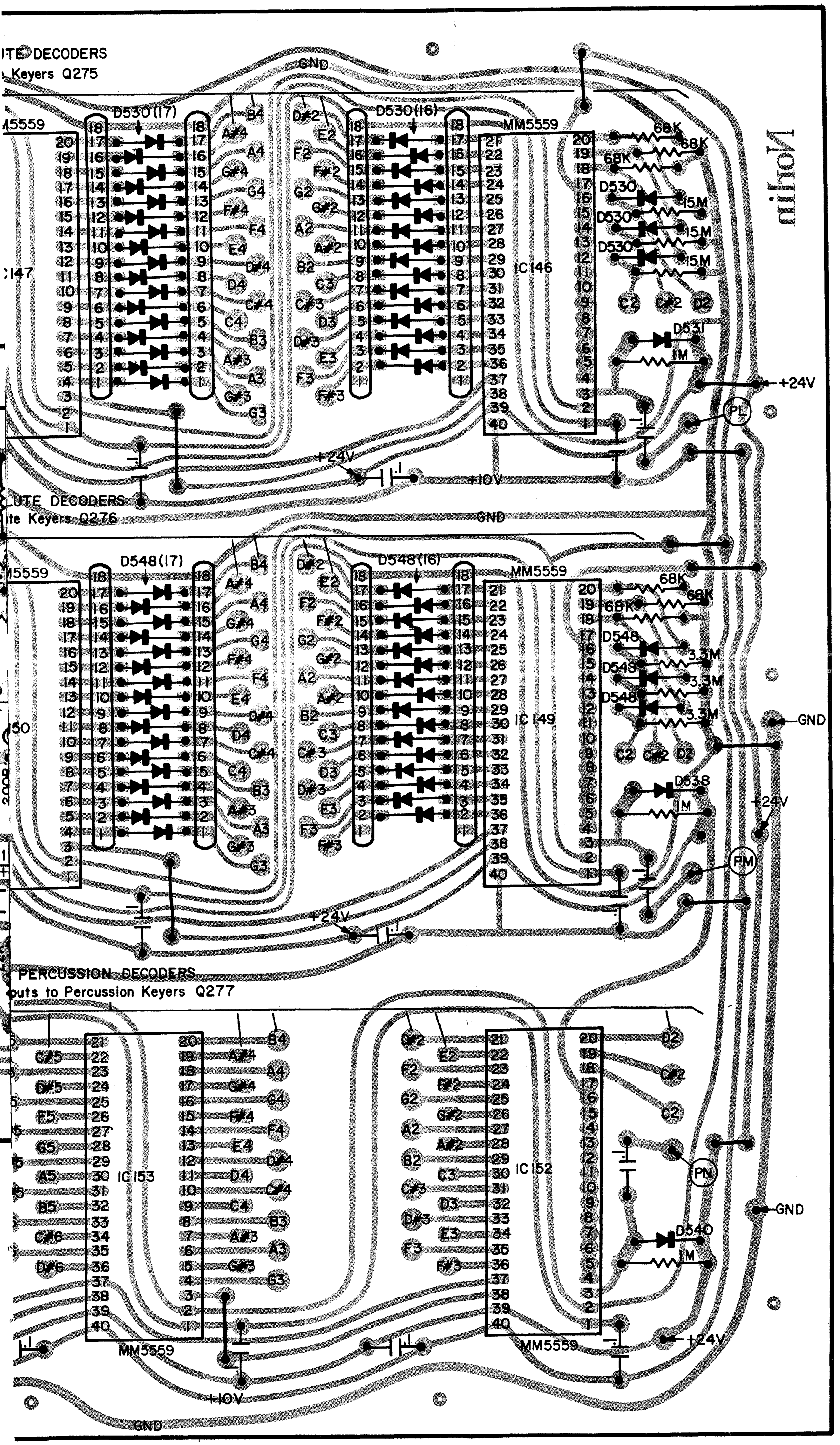
BOARD


980-02420-001
+13V
+17V
+12.5V
+9V
Brush Adj. VR48 50K
Snare Adj. VR45 50K
VR47 Cymbal Adj.
Q413
Q414
Q418
Q419
Q420
Q421
Q422
Q423
Q424
Q425
Q426
Q427
Q429
Q430
Q431
Q432
Q433
L8 10H
L11 10H
L15 27 mh
L16 27mh
L17 27 mh
L18 27 mh
C14
C22
D709
D724
D729
D733
D734
D735
D736
D737
D738
D739
D740
To Pt. TJ
To Pt. VA
To Pt. TK
To Pt. VB
From Pt. VV IC201 Pin7
VJ
VH
VE
VF
VG
VL
VM
GND
Norlin

INSTRUMENTATION

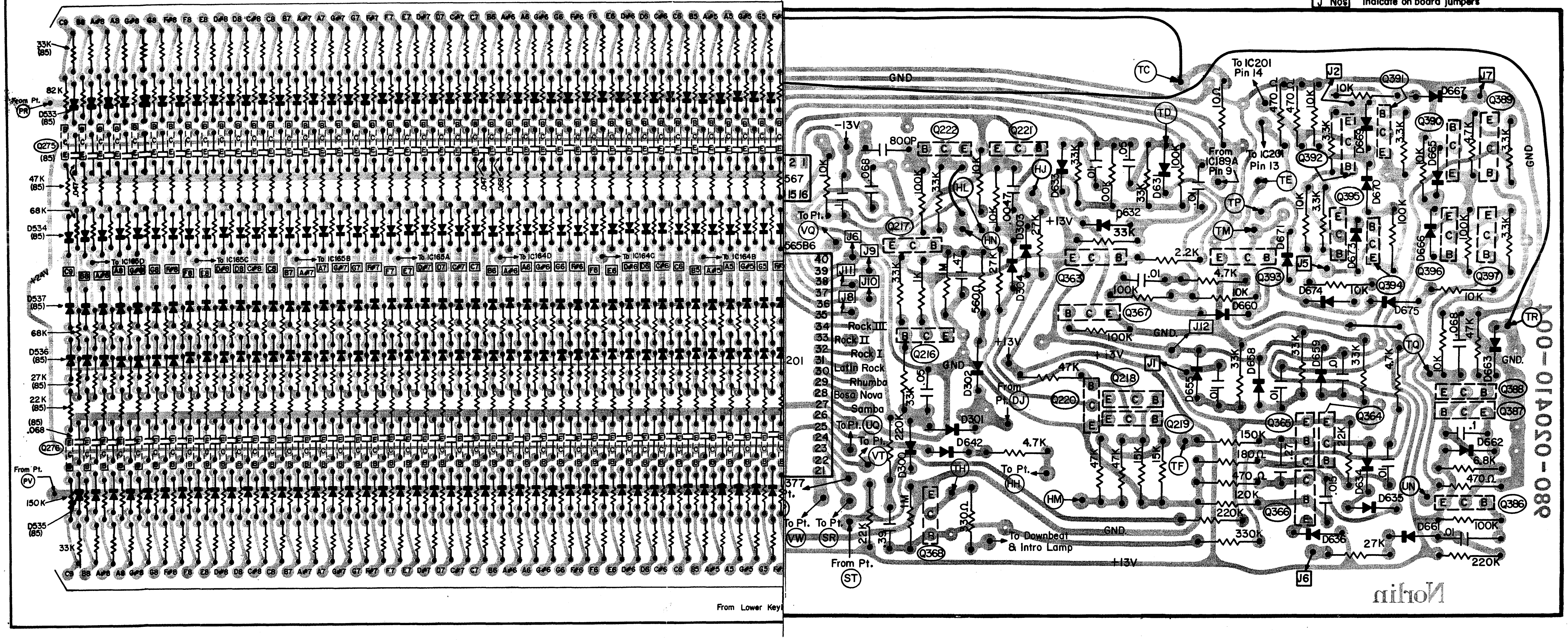

To Pt. EN
From Pin 25
To Pt. UQ
To Pt. UP
Q377
Q428
HP
Q223
Q378
Q415
Q417
Q416
Q412
Q411
Q410
GND
+17V
+13V
+9V
+18V
From IC201 Pin 21 Pt. VW
From Pt. HN
C15 50
R16
R17
R18
D643
D644
D645
D646
D725
D726
D727
D728
D730
D731
D732
L9 1.5H
L10 5H
L12 10H
L13 500 mh
L14 500 mh
VS
VT
VU
VK
VR
VN
350

N DECODER BOARD

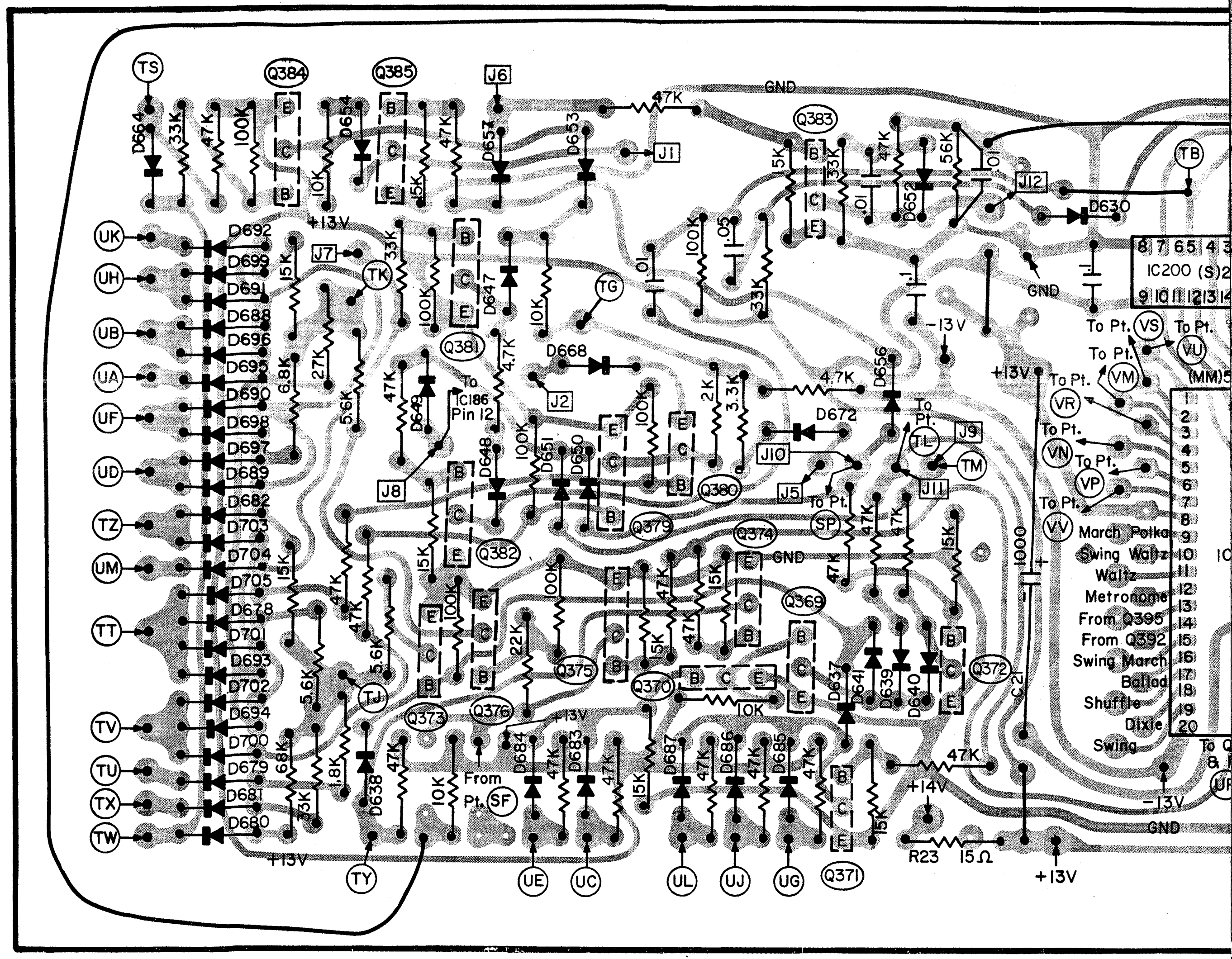

UTE DECODERS
Keyers Q275
MM5559
IC147
IC146
D530(17)
D530(16)
D530
D531
68K
15M
1M
+24V
+10V
GND
PL
UTE DECODERS
ite Keyers Q276
D548(17)
D548(16)
D548
D538
IC149
3.3M
PM
PERCUSSION DECODERS
outs to Percussion Keyers Q277
IC153
IC152
D540
PN
B4
A#4
A4
G#4
G4
F#4
F4
E4
D#4
D4
C#4
C4
B3
A#3
A3
G#3
G3
D#2
E2
F2
F#2
G2
G#2
A2
A#2
B2
C3
C#3
D3
D#3
E3
F3
F#3
C2
C#2
D2
C#5
D#5
F5
G5
A5
B5
C#6
D#6

UPPER & LOWER FLUTE BOARD

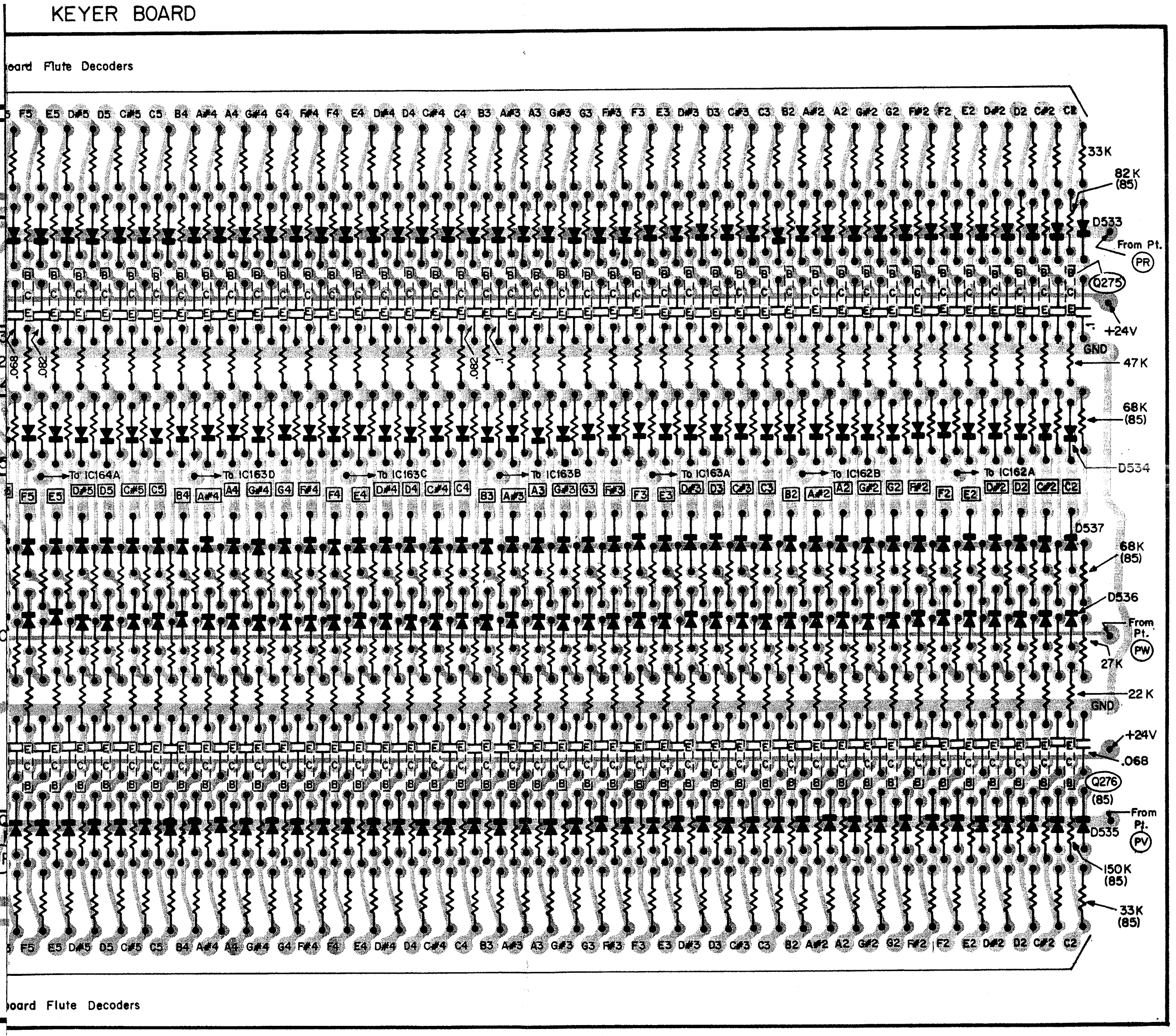
"J" Nos Indicate on board jumpers


From Upper Keyb
From Lower Keyb
33K (85)
82K
From Pt. PR
D533 (85)
Q275 (85)
47K (85)
68K
D534 (85)
D537 (85)
68K
D536 (85)
27K (85)
22K (85)
(85) .068
Q276
From Pt. PV
150K
D535 (85)
33K
To IC165D
To IC165C
To IC165B
To IC165A
To IC164D
To IC164C
To IC164B
GND
-13V
800P
Q222
Q221
Q217
Q216
Q218
Q219
Q220
Q363
Q367
Q368
Q393
Q391
Q389
Q390
Q392
Q395
Q394
Q396
Q397
Q388
Q387
Q386
Q364
Q365
Q366
TC
TD
TE
TP
TM
TQ
TR
TF
TH
HJ
HL
HN
HM
UN
To IC201 Pin 14
To IC201 Pin 13
From IC189A Pin 9
J2
J7
J5
J6
J1
J12
J9
J10
J11
J8
D667
D665
D666
D668
D670
D671
D673
D674
D675
D660
D632
D633
D631
D303
D304
D302
D301
D300
D642
D655
D658
D659
D657
D662
D663
D635
D636
D661
+13V
To Pt. VQ
Rock III
Rock II
Rock I
Latin Rock
Rhumba
Bosa Nova
Samba
To Pt. UQ
To Pt. VT
To Pt. HH
To Pt. VW
To Pt. SR
From Pt. ST
From Pt. DJ
To Downbeat & Intro Lamp
GND.
2.2K
4.7K
100K
10K
33K
47K
27K
150K
180Ω
470Ω
120K
220K
330K
6.8K
5600
22K
39
330Ω
00-01402-086
Norlin

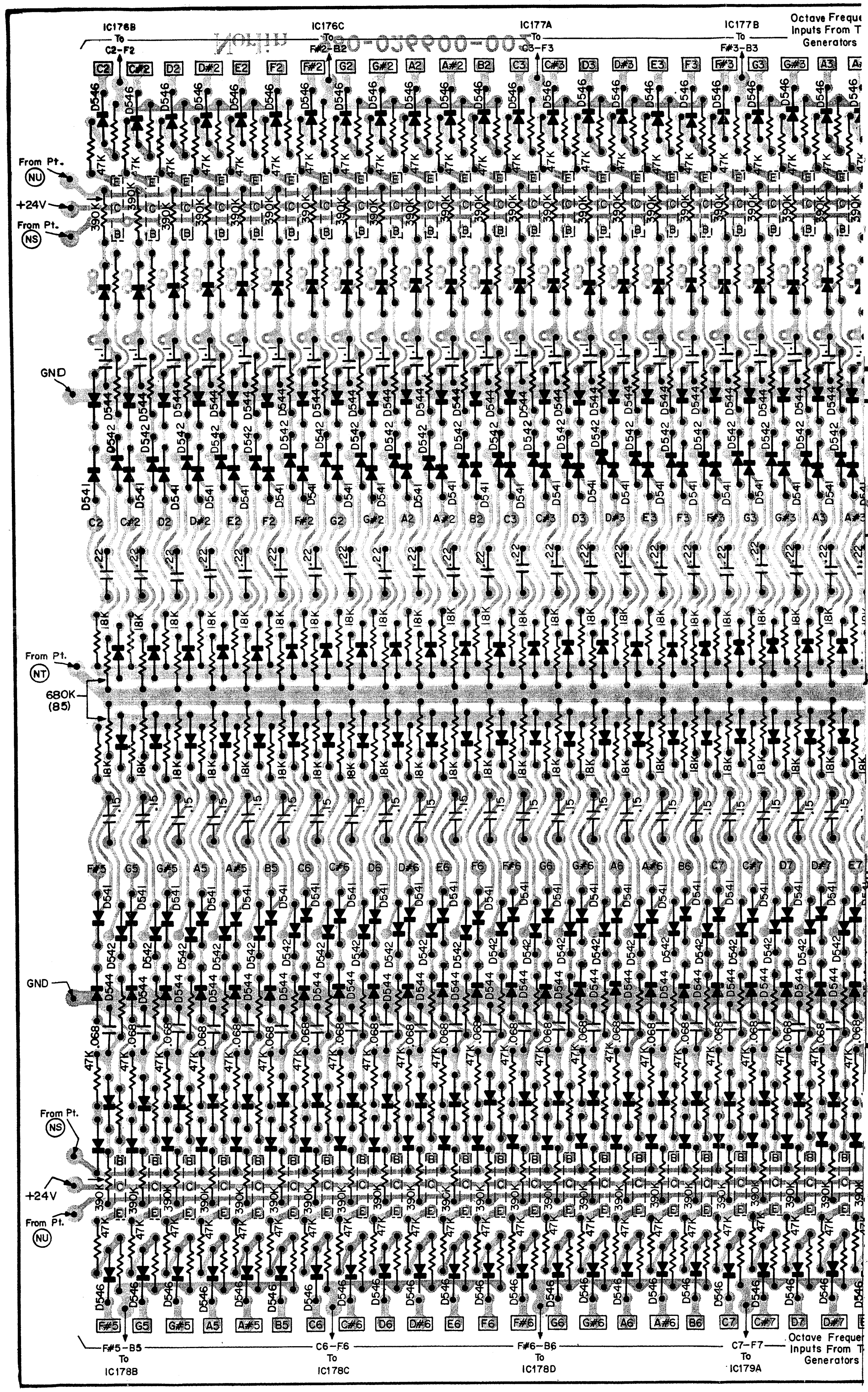
RHYTHM CLOCK


TS
Q384
Q385
J6
GND
47K
Q383
J1
J12
TB
D630
IC200 (S)
D664
33K
47K
100K
D654
10K
15K
D657
D653
+13V
UK
UH
UB
UA
UF
UD
TZ
UM
TT
TV
TU
TX
TW
D692
D699
D691
D688
D696
D695
D690
D698
D697
D689
D682
D703
D704
D705
D678
D701
D693
D702
D694
D700
D679
D681
D680
J7
TK
TG
Q381
To IC186 Pin 12
D668
J2
J8
D647
D648
D651
D650
Q380
Q379
Q382
Q374
Q369
Q375
Q376
Q373
Q370
Q372
Q371
D672
J10
J5
To Pt. SP
To Pt. TL
TM
J9
J11
D656
D652
D637
D641
D639
D640
D638
D684
D683
D687
D686
D685
TJ
TY
UE
UC
UL
UJ
UG
From Pt. SF
R23
15 Ω
+14V
-13V
+13V
GND
1000
To Pt. VS
To Pt. VU
VM
VR
VN
To Pt. VP
VV
March Polka
Swing Waltz
Waltz
Metronome
From Q395
From Q392
Swing March
Ballad
Shuffle
Dixie
Swing

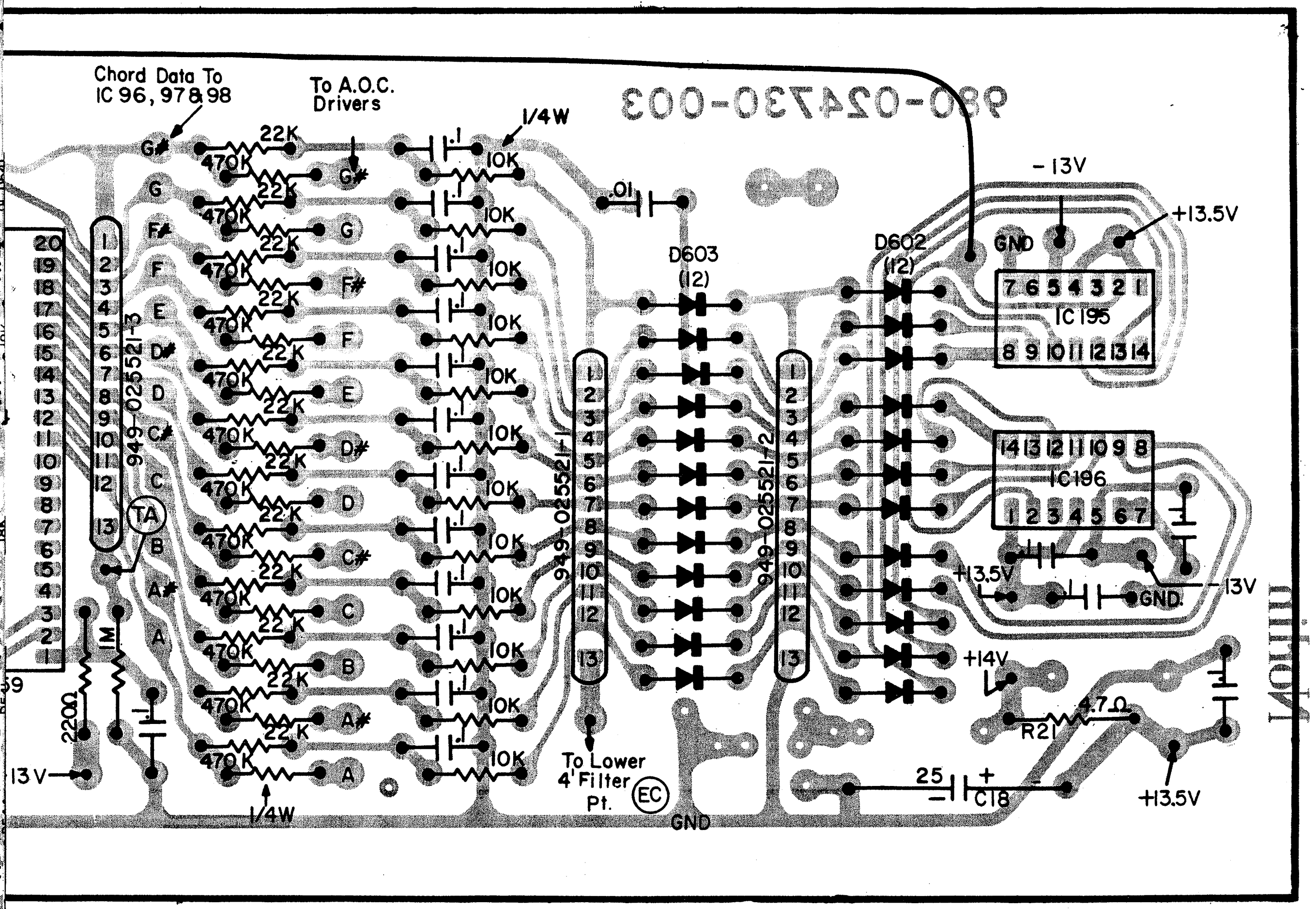
KEYER BOARD


oard Flute Decoders
F5 E5 D#5 D5 C#5 C5 B4 A#4 A4 G#4 G4 F#4 F4 E4 D#4 D4 C#4 C4 B3 A#3 A3 G#3 G3 F#3 F3 E3 D#3 D3 C#3 C3 B2 A#2 A2 G#2 G2 F#2 F2 E2 D#2 D2 C#2 C2
33K
82K (85)
D533
From Pt. PR
Q275
+24V
GND
47K
68K (85)
D534
To IC164A
To IC163D
To IC163C
To IC163B
To IC163A
To IC162B
To IC162A
D537
68K (85)
D536
From Pt. PW
27K
22K
GND
+24V
.068
Q276 (85)
From Pt. PV
D535
150K (85)
33K (85)
oard Flute Decoders

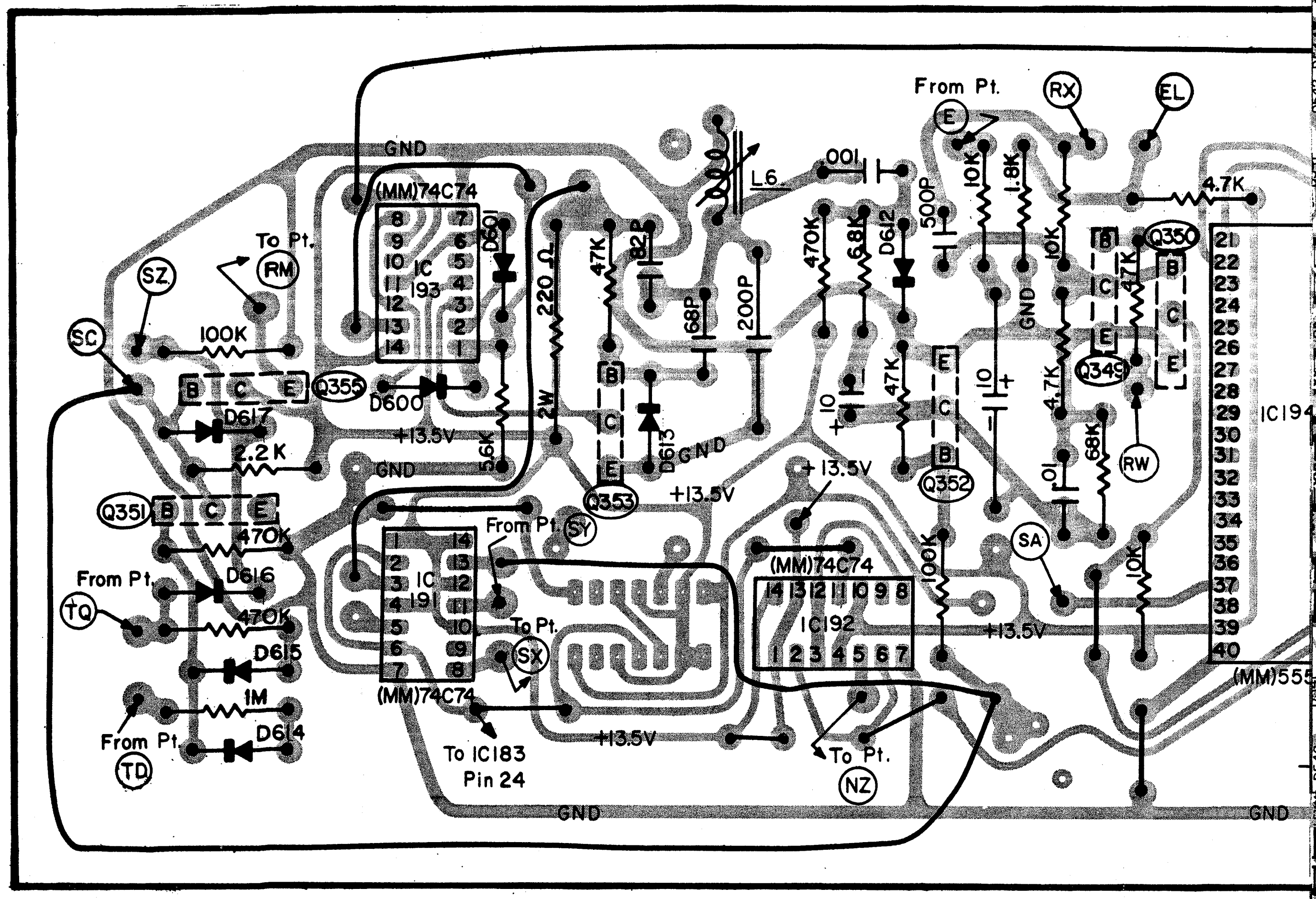
PERCUSS


IC176B To C2–F2
IC176C To F#2–B2
IC177A To G3–F3
IC177B To F#3–B3
Octave Freque
Inputs From T
Generators
C2 C#2 D2 D#2 E2 F2 F#2 G2 G#2 A2 A#2 B2 C3 C#3 D3 D#3 E3 F3 F#3 G3 G#3 A3
D546
47K
390K
From Pt. NU
+24V
From Pt. NS
GND
D544
D542
D541
.22
18K
From Pt. NT
680K (85)
.15
F#5 G5 G#5 A5 A#5 B5 C6 C#6 D6 D#6 E6 F6 F#6 G6 G#6 A6 A#6 B6 C7 C#7 D7 D#7 E7
.068
F#5–B5 To IC178B
C6–F6 To IC178C
F#6–B6 To IC178D
C7–F7 To IC179A
Octave Freque
Inputs From T
Generators

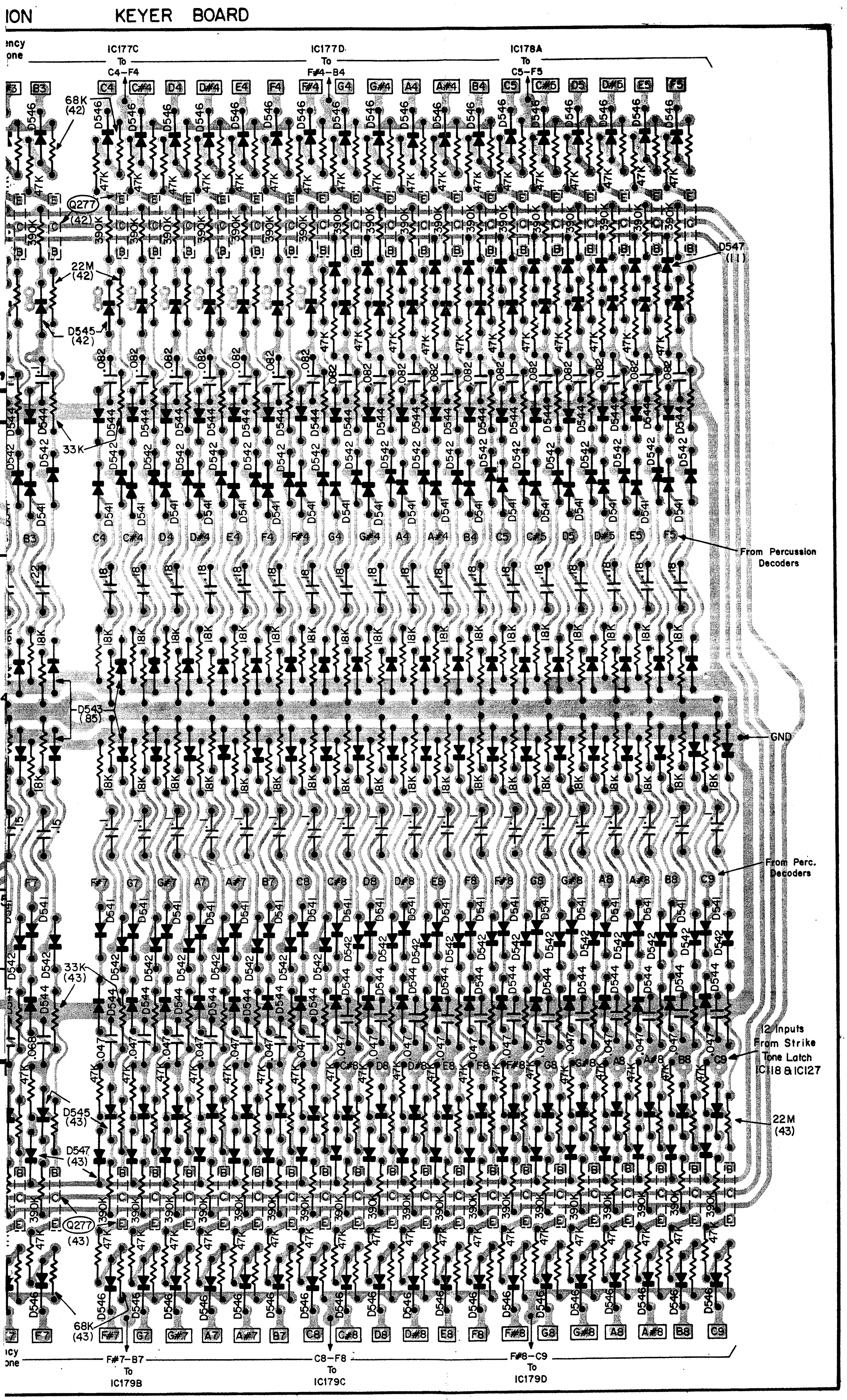
8. OSC. BOARD


Chord Data To IC 96, 97 & 98
To A.O.C. Drivers
1/4W
22K
470K
10K
.1
.01
G# G F# F E D# D C# C B A# A
D603 (12)
D602 (12)
-13V
+13.5V
GND
IC195
IC196
949-02552-1
949-02552-2
949-02552-3
TA
1M
220Ω
13V
To Lower 4' Filter Pt. EC
GND
25
C18
R21
4.7Ω
+14V
+13.5V
GND.
-13V

MAGIC GENIE, 4 T.O.S.,


GND
(MM)74C74
IC 193
D601
L6
.001
From Pt.
RX
EL
E
10K
1.8K
500P
4.7K
Q350
470K
6.8K
D612
47K
82P
68P
200P
220 Ω
2W
To Pt.
RM
SZ
SC
100K
B
C
E
Q355
D600
D617
+13.5V
2.2K
5.6K
Q353
D613
Q351
470K
D616
TQ
D615
1M
D614
TD
IC 191
SY
SX
IC192
To IC183 Pin 24
NZ
Q352
Q349
68K
.01
RW
SA
IC194
(MM)555

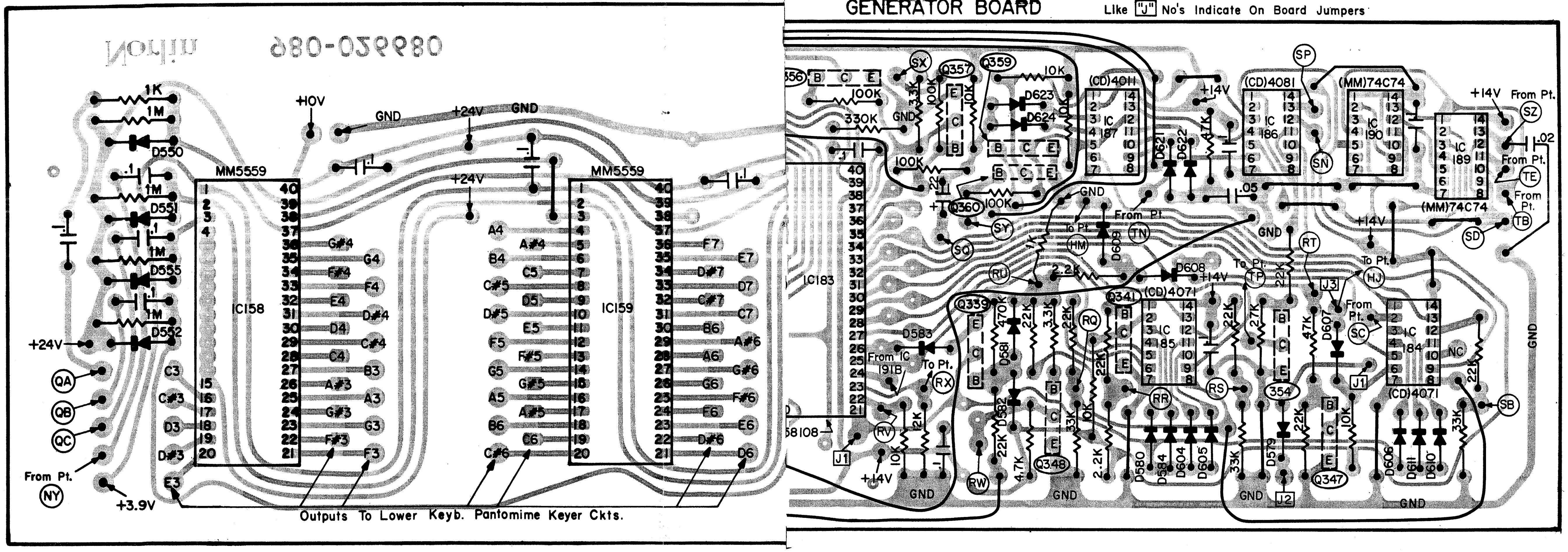
ION KEYER BOARD


ency
one
IC177C To C4–F4
IC177D To F#4–B4
IC178A To C5–F5
B3
C4
C#4
D4
D#4
E4
F4
F#4
G4
G#4
A4
A#4
B4
C5
C#5
D5
D#5
E5
F5
68K (42)
D546
47K
Q277 (42)
390K
22M (42)
D545 (42)
D547 (11)
.082
D544
D542
D541
33K
From Percussion Decoders
.18
18K
D543 (85)
GND
.15
From Perc. Decoders
F#7
G7
G#7
A7
A#7
B7
C8
C#8
D8
D#8
E8
F8
F#8
G8
G#8
A8
A#8
B8
C9
33K (43)
.047
.068
12 Inputs From Strike Tone Latch IC118 & IC127
22M (43)
D545 (43)
D547 (43)
Q277 (43)
68K (43)
F7
F#7–B7 To IC179B
C8–F8 To IC179C
F#8–C9 To IC179D

PANTOMIME DE

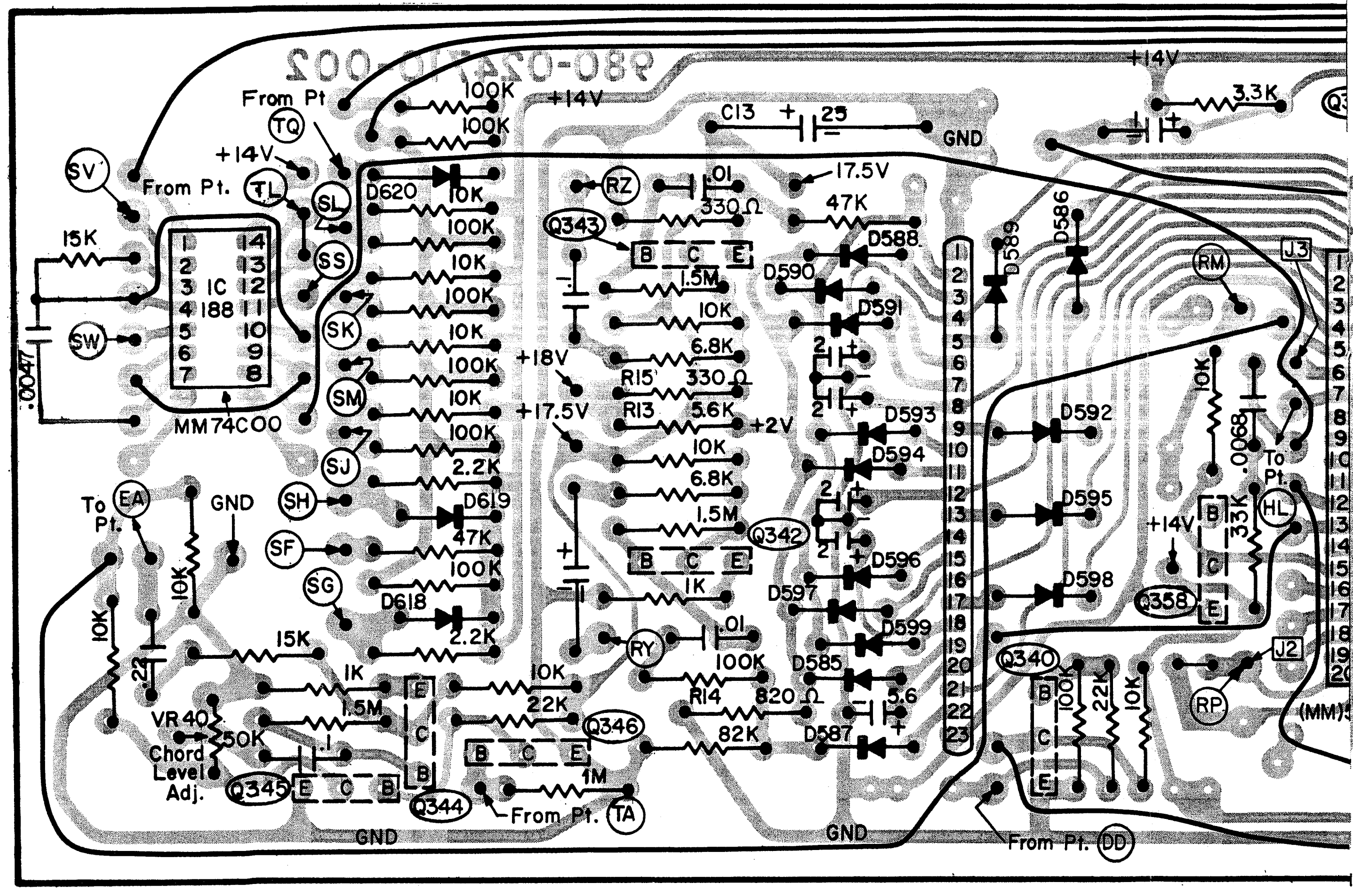
GENERATOR BOARD

Like "J" No's Indicate On Board Jumpers

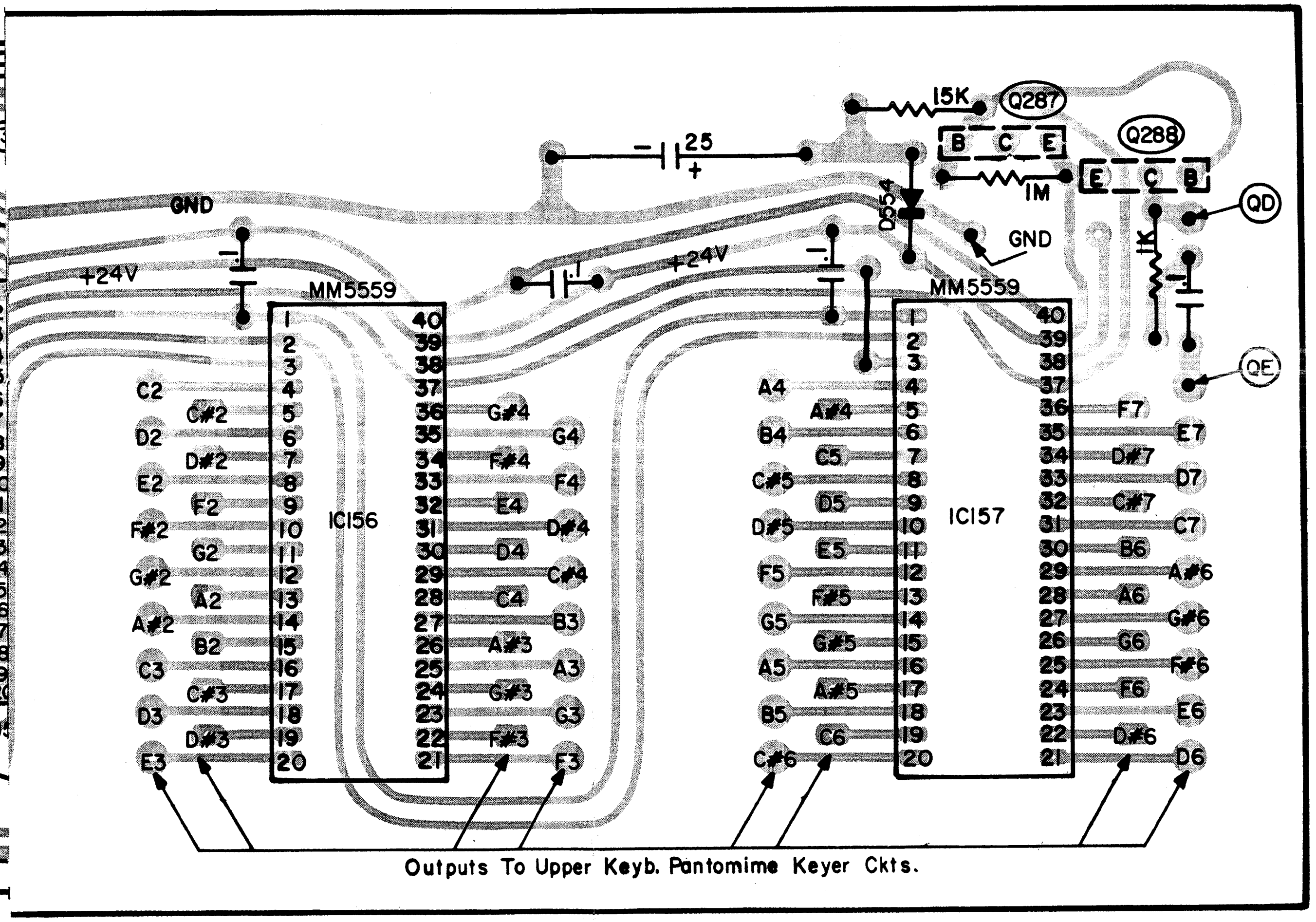


Norlin 089-025980
1K
1M
D550
D551
D555
D552
+24V
QA
QB
QC
From Pt.
NY
+3.9V
+10V
GND
+24V
GND
MM5559
IC158
MM5559
IC159
C3
C#3
D3
D#3
E3
G#4
G4
F#4
F4
E4
D#4
D4
C#4
C4
B3
A#3
A3
G#3
G3
F#3
F3
A4
A#4
B4
C5
C#5
D5
D#5
E5
F5
F#5
G5
G#5
A5
A#5
B6
C6
C#6
F7
E7
D#7
D7
C#7
C7
B6
A#6
A6
G#6
G6
F#6
F6
E6
D#6
D6
Outputs To Lower Keyb. Pantomime Keyer Ckts.
IC183
SX
Q357
Q359
10K
D623
D624
(CD)4011
IC 187
100K
330K
3.3K
Q360
SY
SQ
RU
HM
TN
D609
D608
2.2K
GND
From Pt.
To Pt.
D621
D622
+14V
47K
.05
(CD)4081
IC 186
SP
SN
(MM)74C74
IC 190
+14V
From Pt.
SZ
.02
IC 189
TE
TB
SD
(MM)74C74
GND
RT
TP
HJ
J3
SC
From Pt.
D607
(CD)4071
IC 184
NC
SB
Q339
D583
From IC 191B
To Pt.
RX
RV
J1
+14V
D581
D582
470K
22K
33K
4.7K
RW
Q348
Q341
(CD)4071
IC 185
RQ
RR
RS
D580
D584
D604
D605
354
D579
Q347
J2
D606
D611
D610
GND

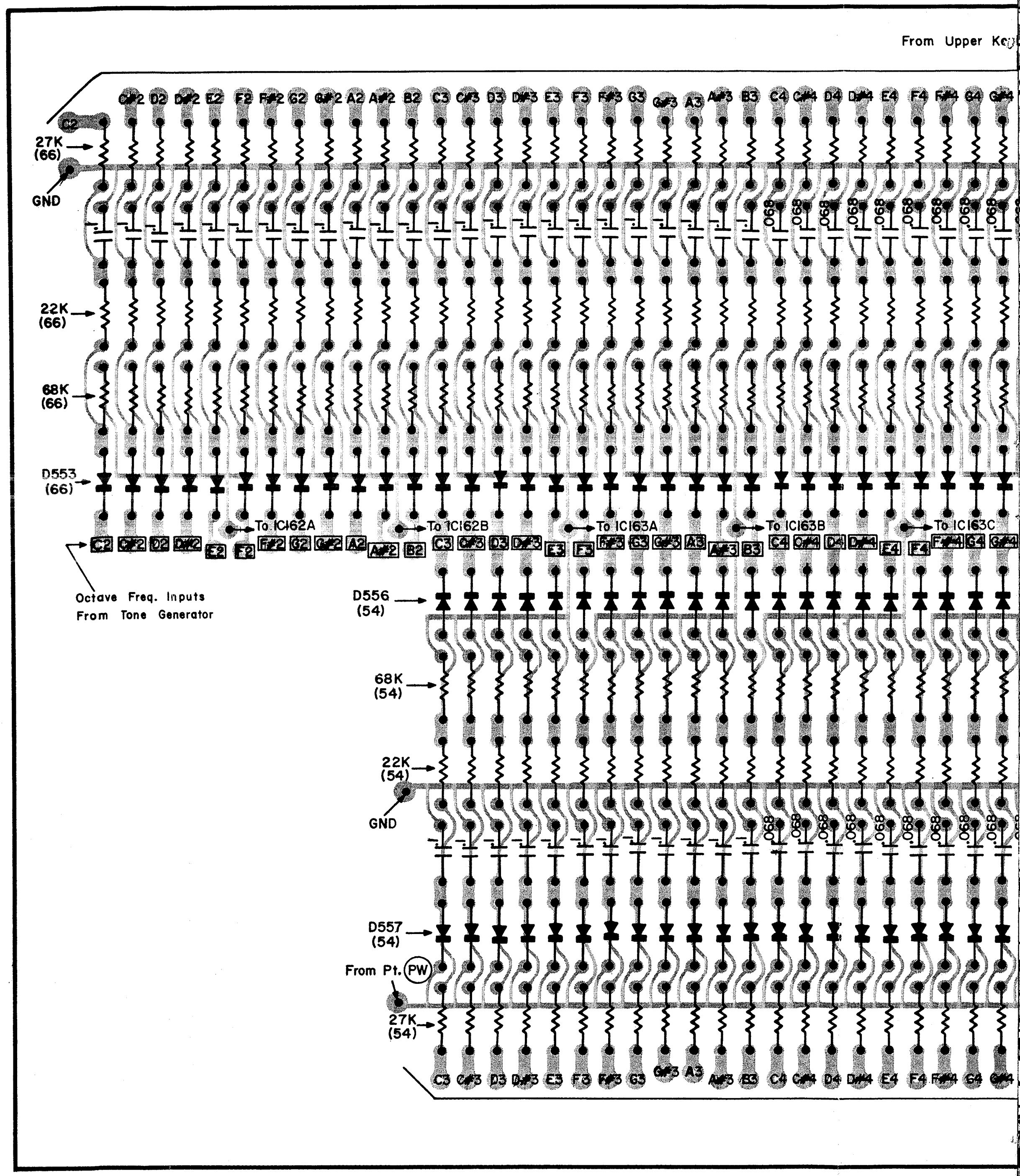
CHORD FUNCTION


980-024710-002
From Pt. TQ
From Pt. TL
+14V
SV
SL
SS
SK
SM
SJ
SH
SF
SG
15K
IC 188
MM74C00
.0047
SW
To Pt. EA
GND
10K
27
15K
1K
1.5M
VR40
50K
Chord Level Adj.
Q345
Q344
Q346
Q343
Q342
Q340
Q358
From Pt. TA
From Pt. DD
D620
D619
D618
100K
10K
47K
2.2K
+18V
+17.5V
+2V
C13
25
GND
RZ
.01
330Ω
17.5V
R15
R13
R14
6.8K
5.6K
1.5M
1K
RY
820Ω
82K
22K
1M
D585
D586
D587
D588
D589
D590
D591
D592
D593
D594
D595
D596
D597
D598
D599
5.6
3.3K
RM
J3
J2
RP
HL
.068
33K
To Pt.
+14V
(MM)

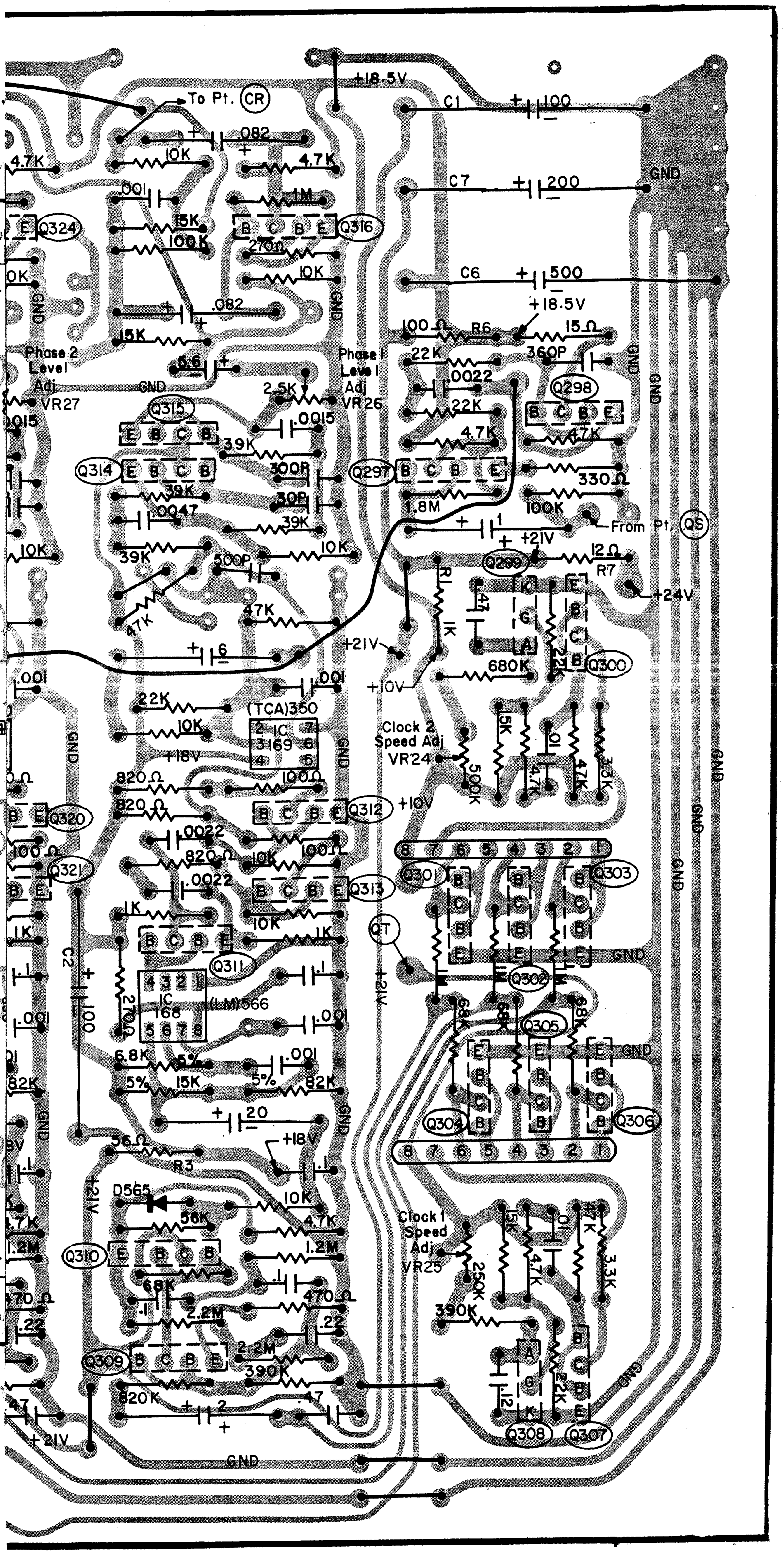
CODER BOARD


15K
Q287
Q288
1M
25
GND
+24V
D554
1K
QD
QE
MM5559
IC156
IC157
C2
C#2
D2
D#2
E2
F2
F#2
G2
G#2
A2
A#2
B2
C3
C#3
D3
D#3
E3
G#4
G4
F#4
F4
E4
D#4
D4
C#4
C4
B3
A#3
A3
G#3
G3
F#3
F3
A4
A#4
B4
C5
C#5
D5
D#5
E5
F5
F#5
G5
G#5
A5
A#5
B5
C6
C#6
F7
E7
D#7
D7
C#7
C7
B6
A#6
A6
G#6
G6
F#6
F6
E6
D#6
D6
Outputs To Upper Keyb. Pantomime Keyer Ckts.

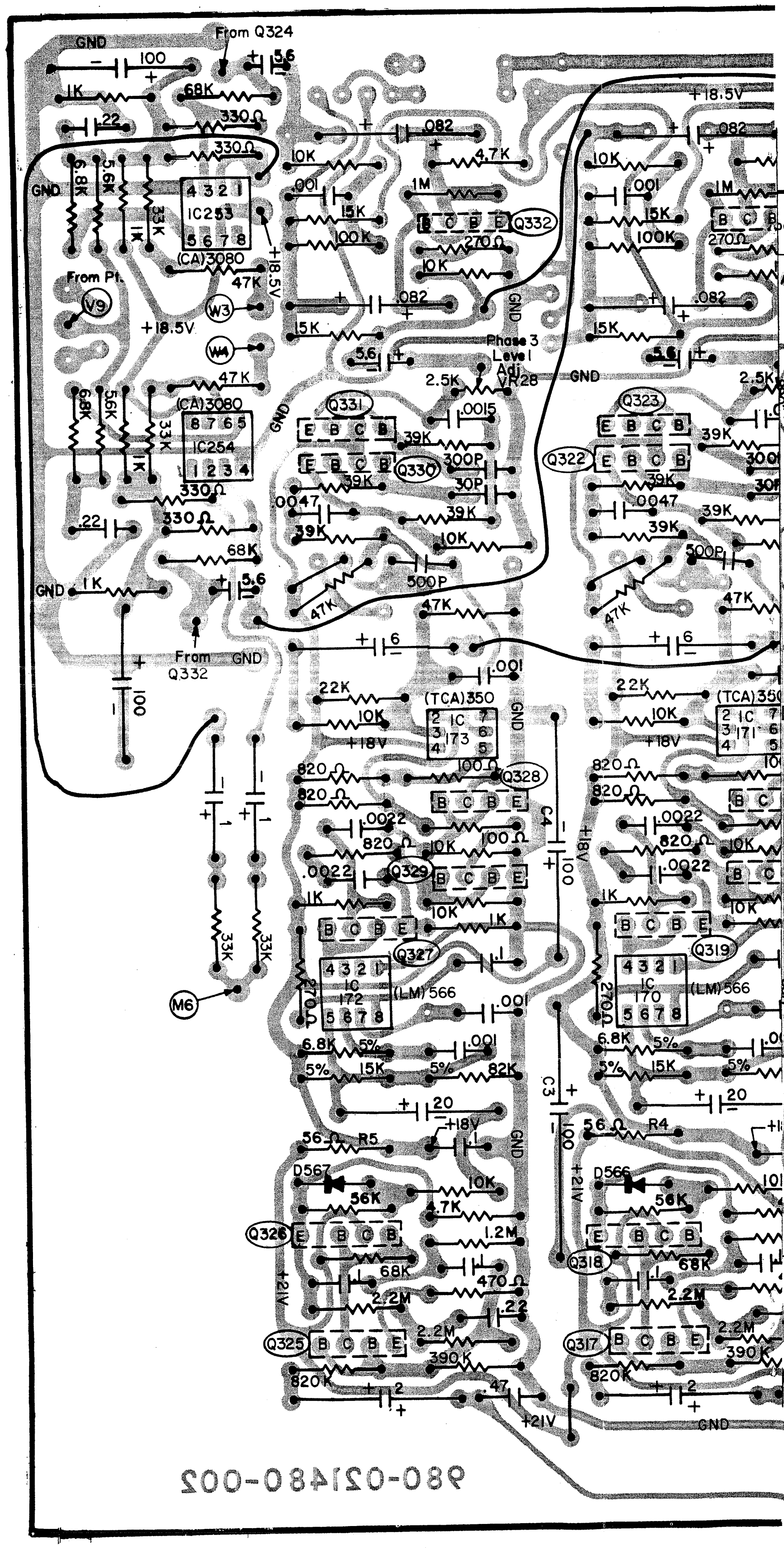
PANTOMIME


From Upper Key
27K (66)
GND
22K (66)
68K (66)
D553 (66)
To IC162A
To IC162B
To IC163A
To IC163B
To IC163C
Octave Freq. Inputs From Tone Generator
D556 (54)
68K (54)
22K (54)
GND
D557 (54)
From Pt. (PW)
27K (54)
C2 C#2 D2 D#2 E2 F2 F#2 G2 G#2 A2 A#2 B2 C3 C#3 D3 D#3 E3 F3 F#3 G3 G#3 A3 A#3 B3 C4 C#4 D4 D#4 E4 F4 F#4 G4 G#4
C3 C#3 D3 D#3 E3 F3 F#3 G3 G#3 A3 A#3 B3 C4 C#4 D4 D#4 E4 F4 F#4 G4 G#4
.068

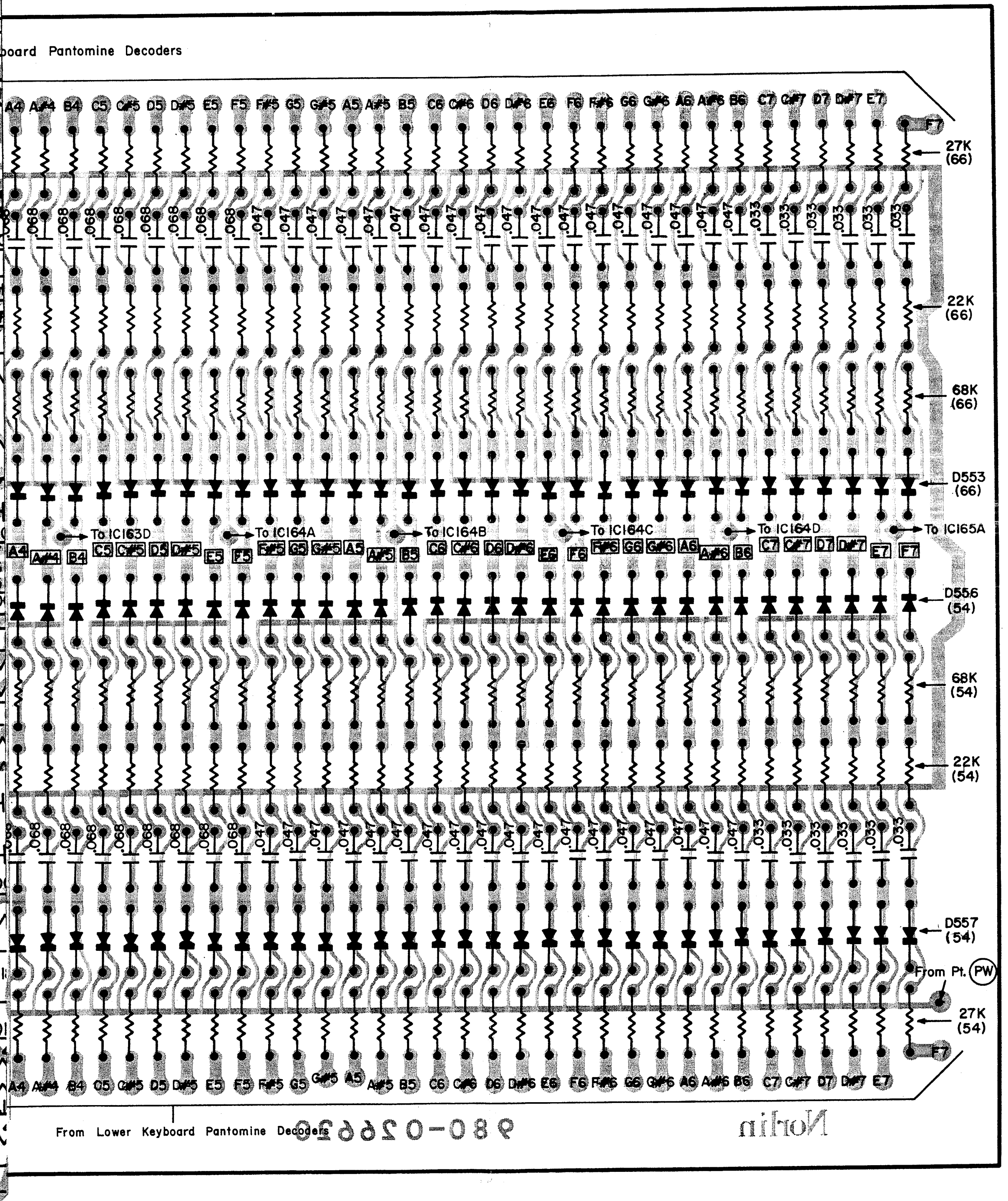
)DULATOR


+18.5V
To Pt. (CR)
C1
100
C7
200
C6
500
GND
Q324
Q316
Q315
Q314
Q297
Q298
Q299
Q300
Q301
Q302
Q303
Q304
Q305
Q306
Q307
Q308
Q309
Q310
Q311
Q312
Q313
Q320
Q321
Phase 2 Level Adj VR27
Phase 1 Level Adj VR26
R6
R7
From Pt. (QS)
+21V
+24V
+10V
Clock 2 Speed Adj VR24
Clock 1 Speed Adj VR25
(TCA)350 IC169
IC168 (LM)566
+18V
R3
D565
C2
(QT)

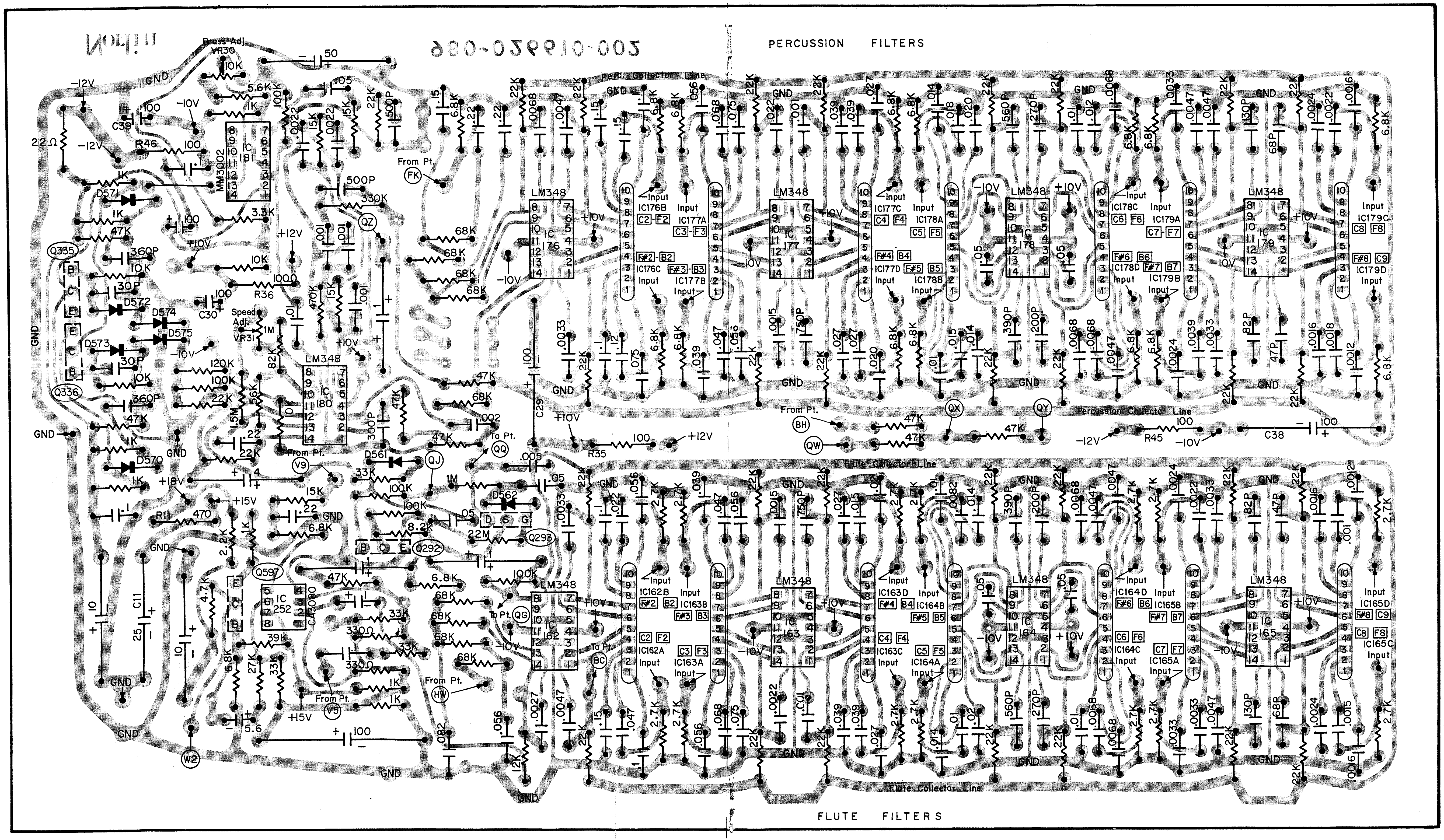
CHORUS MC


GND
From Q324
100
1K
68K
330Ω
.22
5.6
6.8K
5.6K
33K
IC253
(CA)3080
IC254
+18.5V
From Pt. V9
W3
W4
47K
From Q332
M6
10K
.001
15K
100K
1M
.082
4.7K
Q332
Q331
Q330
Q329
Q328
Q327
Q326
Q325
Q323
Q322
Q319
Q318
Q317
Phase 3 Level Adj. VR28
2.5K
39K
300P
30P
.0047
500P
47K
22K
(TCA)350
IC 173
IC 171
820Ω
.0022
IC 172
IC 170
(LM)566
6.8K
5%
82K
20
+18V
56Ω R5
R4
D567
D566
56K
4.7K
1.2M
68K
2.2M
470Ω
390K
820K
+21V
C3
C4
980-021480-002

KEYER BOARD


Board Pantomine Decoders
A4 A#4 B4 C5 C#5 D5 D#5 E5 F5 F#5 G5 G#5 A5 A#5 B5 C6 C#6 D6 D#6 E6 F6 F#6 G6 G#6 A6 A#6 B6 C7 C#7 D7 D#7 E7
F7
27K (66)
22K (66)
68K (66)
D553 (66)
To IC163D
To IC164A
To IC164B
To IC164C
To IC164D
To IC165A
D556 (54)
68K (54)
22K (54)
D557 (54)
From Pt. PW
27K (54)
.068
.047
.033
From Lower Keyboard Pantomine Decoders
980-02662
Norlin

FLUTE & PERCUSSION FILTER BOARD


PERCUSSION FILTERS
Perc. Collector Line
Percussion Collector Line
FLUTE FILTERS
Flute Collector Line
Brass Adj. VR30
Speed Adj. VR31
MM3002 IC 181
LM348 IC 180
LM348 IC 176
LM348 IC 177
LM348 IC 178
LM348 IC 179
LM348 IC 162
LM348 IC 163
LM348 IC 164
LM348 IC 165
CA3080 IC 252
Q335
Q336
Q292
Q293
Q597
D570
D571
D572
D573
D574
D575
D561
D562
From Pt. FK
From Pt. BH
From Pt. HW
From Pt. V5
From Pt. V9
To Pt. QQ
To Pt. QG
To Pt. BC
QJ
QZ
QX
QY
QW
W2
GND
+10V
-10V
+12V
-12V
+15V
+18V
C29
C30
C38
C39
C11
R11
R35
R36
R45
R46

MODEL H25-4/C500 SERVICE MANUAL SUPPLEMENT

A Pedal Latch Circuit Board has been added to later-production H25-4/C500 organs. This board is physically located to the immediate right of the voltage distribution board. (Refer to Board Location Diagram in the H25-4/C500 Service Manual.) Included in the Supplement is a Schematic, Board Layout, Parts List and Circuit Description of the new Pedal Latch Board. Also included are the Board Layout and Schematic that change with the addition of the new board.

IC2 PEDAL LATCH

The Pedal Oscillator IC1 applies 500KHz directly to the Pedal Latch IC2. The Pedal Latch contains the required logic to generate five octave frequencies (1, 2, 4, 8, 16) corresponding to the pedal that is pressed. The Pedal Latch has a low note priority. This enables the lowest pedal (farthest to the left) to have an output when two or more pedals are pressed together. Once a pedal is pressed and released, the audio outputs remain until a new pedal is pressed. The pedal keyswitch inputs are normally high (+13 volts) and go low (ground) when active. Each time a pedal is pressed, a negative going pulse is outputted at Pin 2. This pulse is inverted by Q2 Pulse Keyer and used to drive the pedal wow and pedal rhythm circuits. The output at Pin 16 switches low for the duration of the pedal down. This low level is inverted by Q1 Pedal Keyer and drives the Pedal Keydown Detector.

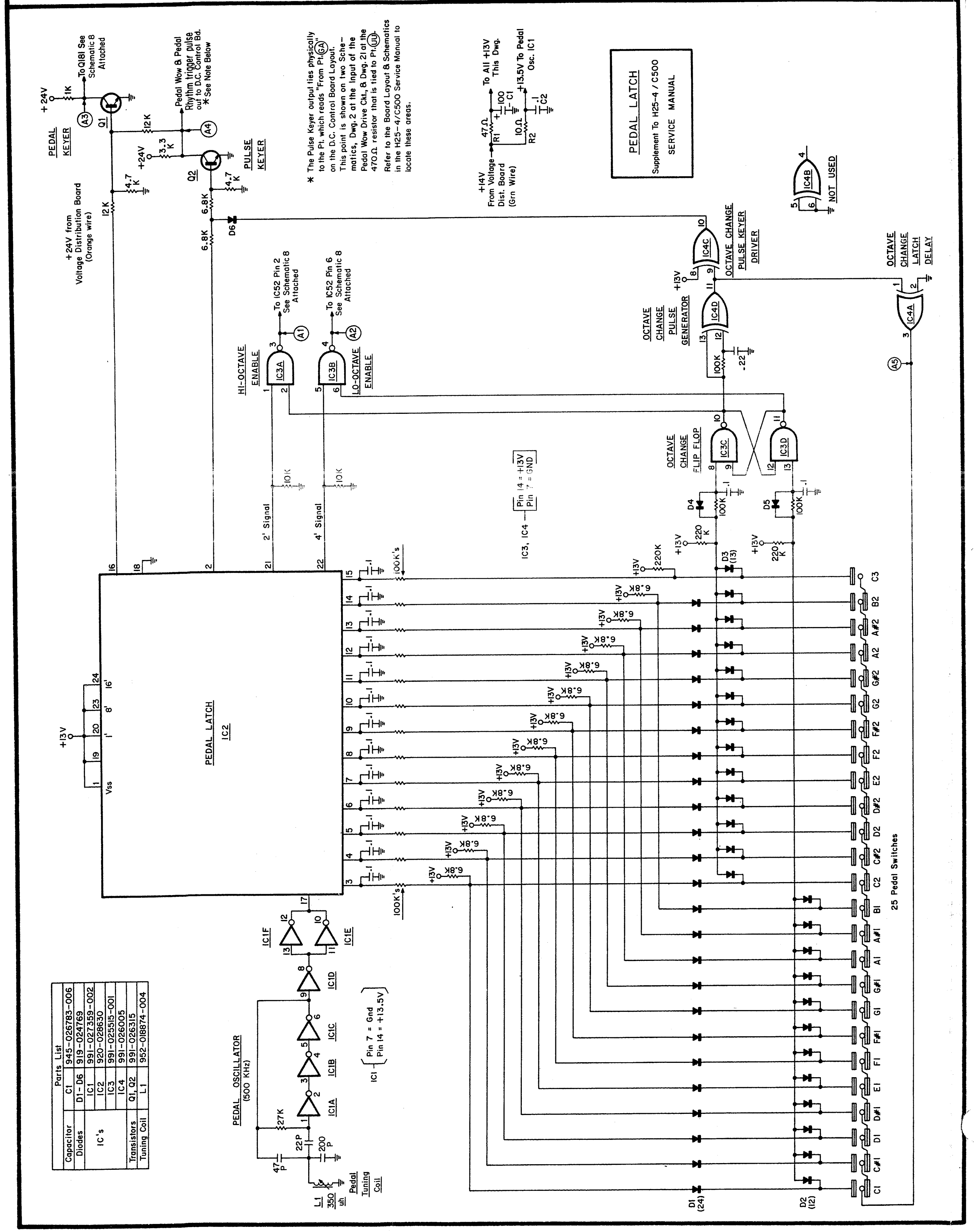
A capacitor is connected to each pedal keyswitch input (Pins 3-15). The pull-up resistor at Pin 15 (C3 pedal input) has higher resistance than the other pedal pull-up resistors, giving the capacitor at Pin 15 a longer charging time constant. At power turn on, Pin 15 momentarily remains low (due to the long time constant. The Pedal Latch senses this as a pedal down and latches on the C3 pedal frequencies.
NOTE: Only the Pedal 2- and 4-foot frequency outputs are used.

OCTAVE CHANGE LOGIC

The Octave Change Flip-Flop IC3A&B changes state each time an octave change occurs. Playing a Pedal in the C1-B1 range applies a low level to Pin 13 of IC3B. The output of this gate goes high and is applied to the Low Octave Enable Gate IC3D. This enables gate IC3D which allows the 4-foot audio signal from Pin 22 of the Pedal Latch to pass to the pedal divider. Playing a pedal in the C2-C3 range causes the Octave Change Flip-Flop to change state and Pin 10 of IC3A now goes high. This high level is applied to Pin 2 of the High Octave Enable Gate IC3C and allows the 2-foot audio signal from Pin 21 of the Pedal Latch to pass to the pedal divider.

The output of IC3A Pin 10 is also applied to the input of Exclusive OR Gate IC4D. Each time the Octave Change Flip-Flop changes state, Pin 10 of IC3A will make a low to high, or a high to low transition, depending on its previous state. This high or low level is applied to both inputs of IC4D. Because of the RC network connected to Pin 12 of IC4D, these inputs will be opposite until the RC time constant is satisfied. This causes IC4D to develop a positive pulse at its output for the duration of this RC time constant. (It should be noted that it makes no difference to what state the octave change Flip-Flop has changed. The capacitor at Pin 12 of IC4D is either charged or discharged depending on the Flip-Flop state. The inputs to IC4D will be opposite each time the Flip-Flop changes state causing IC4D to generate a positive pulse each time an octave change is detected.) The output of IC4D is connected to Pin 1 of IC4A. With Pin 2 of IC4A grounded, the positive pulse developed by IC4D is passed by IC4A and routed through the pedal switches to the active input pin of the Pedal Latch. This inhibits the Pedal Latch momentarily during an octave change and ensures the output select circuits have stabilized before an audio signal is outputted from the Pedal Latch. The output of IC4D is also connected to Pin 9 of IC4C. With Pin 8 of IC4C connected to B+ it generates a negative going pulse each time an octave change occurs. To better understand the function of this gate, consider the following example. Assume the C1 pedal is being played and the C2 pedal is to be selected next. Since these two pedals share a common input to the Pedal Latch a possibility exists where the Pedal Latch would not detect a new keydown. Although the low Keyer level from Pin 16 of the Pedal Latch would be present and the octave select circuitry would be activated, a pulse would not be generated at Pin 2 of the Pedal Latch to key the pedal wow and pedal rhythm circuits. To prevent this condition from occurring, IC4C generates a negative going pulse and assures Q2 will have an output each time an octave change is detected.

PEDAL LATCH SUPPLEMENT SCHEMATIC

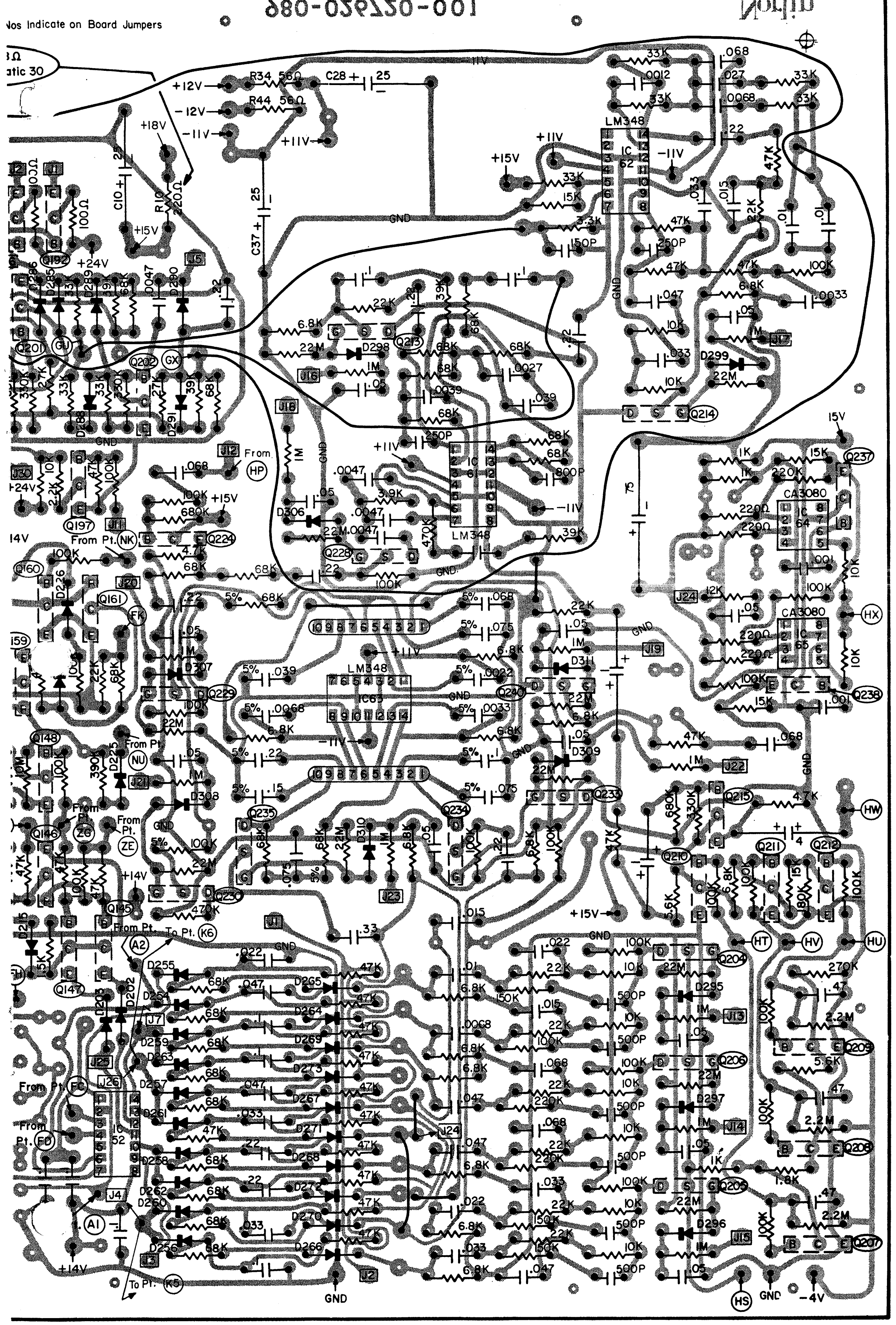

PEDAL LATCH
Supplement To H25-4 / C500
SERVICE MANUAL
PEDAL KEYER
PULSE KEYER
+24V from Voltage Distribution Board (Orange wire)
To Q181 See Schematic 8 Attached
Pedal Wow & Pedal Rhythm trigger pulse out to D.C. Control Bd. * See Note Below
+14V From Voltage Dist. Board (Grn Wire)
To All +13V This Dwg.
+13.5V To Pedal Osc. IC1
HI-OCTAVE ENABLE
LO-OCTAVE ENABLE
To IC52 Pin 2 See Schematic 8 Attached
To IC52 Pin 6 See Schematic 8 Attached
OCTAVE CHANGE PULSE GENERATOR
OCTAVE CHANGE PULSE KEYER DRIVER
OCTAVE CHANGE LATCH DELAY
OCTAVE CHANGE FLIP FLOP
NOT USED
IC3, IC4 — Pin 14 = +13V, Pin 7 = GND
PEDAL LATCH IC2
2' Signal
4' Signal
PEDAL OSCILLATOR (500 KHz)
IC1 — Pin 7 = Gnd, Pin 14 = +13.5V
L1 350 µh Pedal Tuning Coil
25 Pedal Switches
C3
B2
A#2
A2
G#2
G2
F#2
F2
E2
D#2
D2
C#2
C2
B1
A#1
A1
G#1
G1
F#1
F1
E1
D#1
D1
C#1
C1

* The Pulse Keyer output ties physically to the Pt. which reads "From Pt. (GA)" on the D.C. Control Board Layout. This point is shown on two Schematics, Dwg. 2 at the Input of the Pedal Wow Drive Ckt., & Dwg. 21 at the 470Ω resistor that is tied to Pt. (UU).

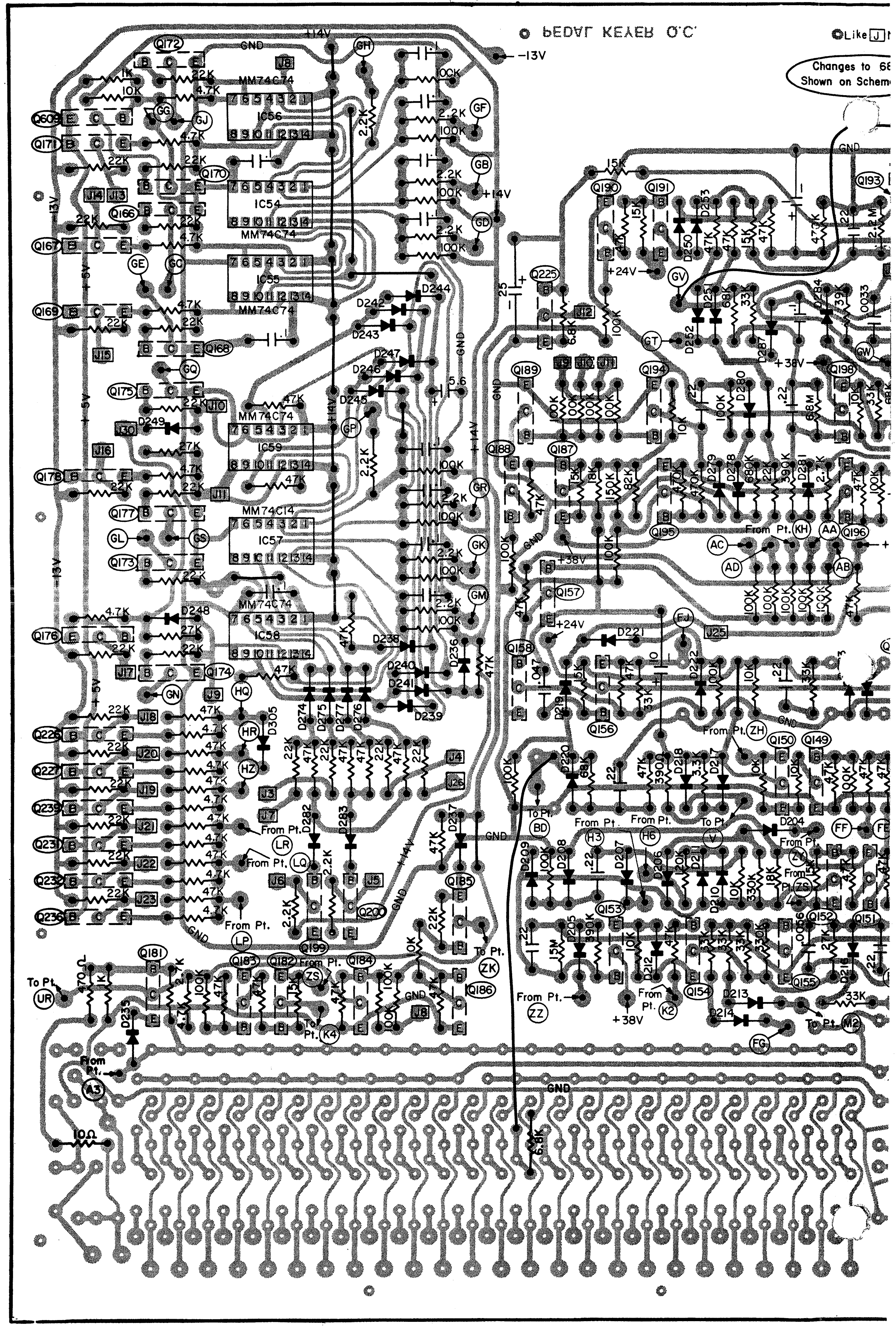
Refer to the Board Layout & Schematics in the H25-4/C500 Service Manual to locate these areas.

Parts List		
Capacitor	C1	945-0267783-006
Diodes	D1 - D6	919-0247769
IC's	IC1	991-0273559-002
	IC2	920-0286630
	IC3	991-025515-001
	IC4	991-0260005
Transistors	Q1, Q2	991-026315
Tuning Coil	L1	952-018874-004

(For Organs With Pedal Latch Ckt. Board)

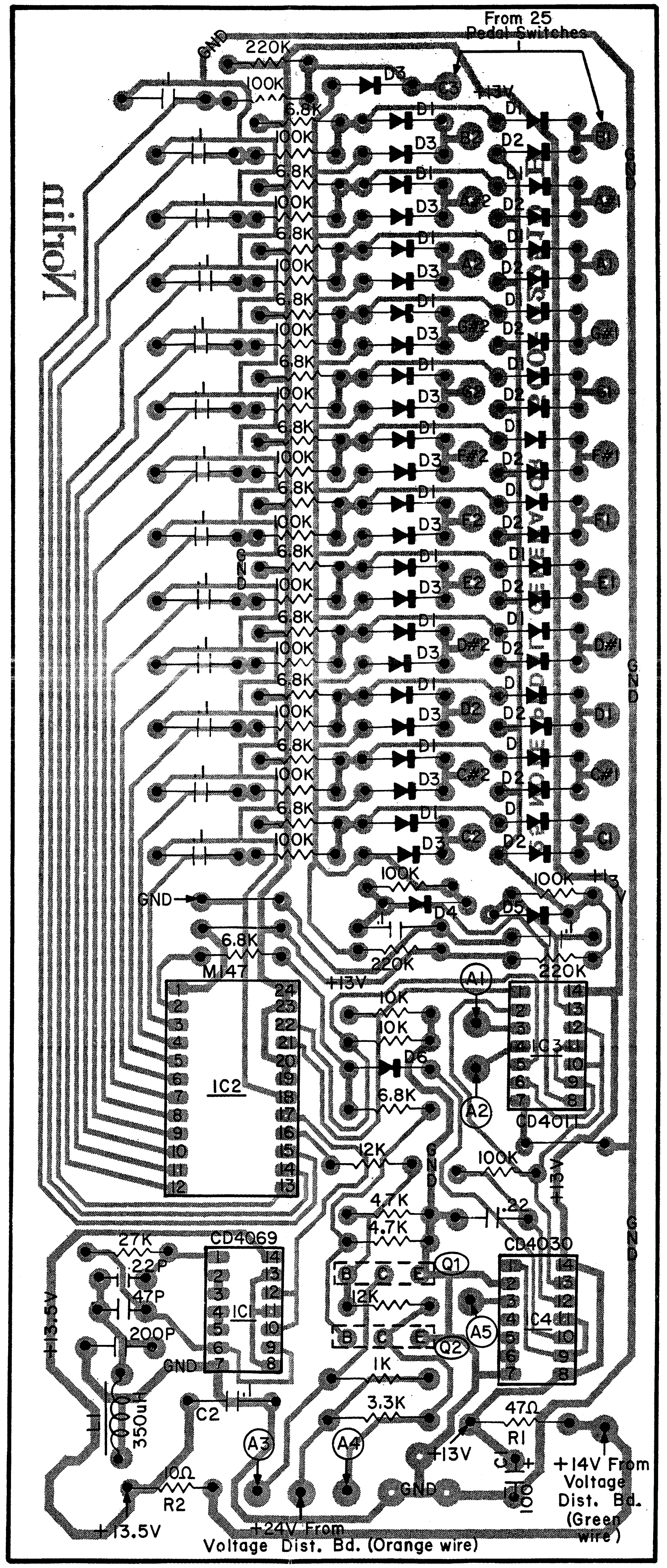

Nos Indicate on Board Jumpers
980-027920-001
Norlin
LM348
CA3080
IC63
+15V
+11V
-11V
GND
+14V
-4V
+24V

PEDAL SYMPHONIZER Q.C. & CONTROL BD.



PEDAL KEYER Q.C.
Like J
Changes to 68
Shown on Schem
-13V
+14V
GND
MM74C74
IC54
IC55
IC56
IC57
IC58
IC59
MM74C14
+24V
+38V
From Pt.
To Pt.

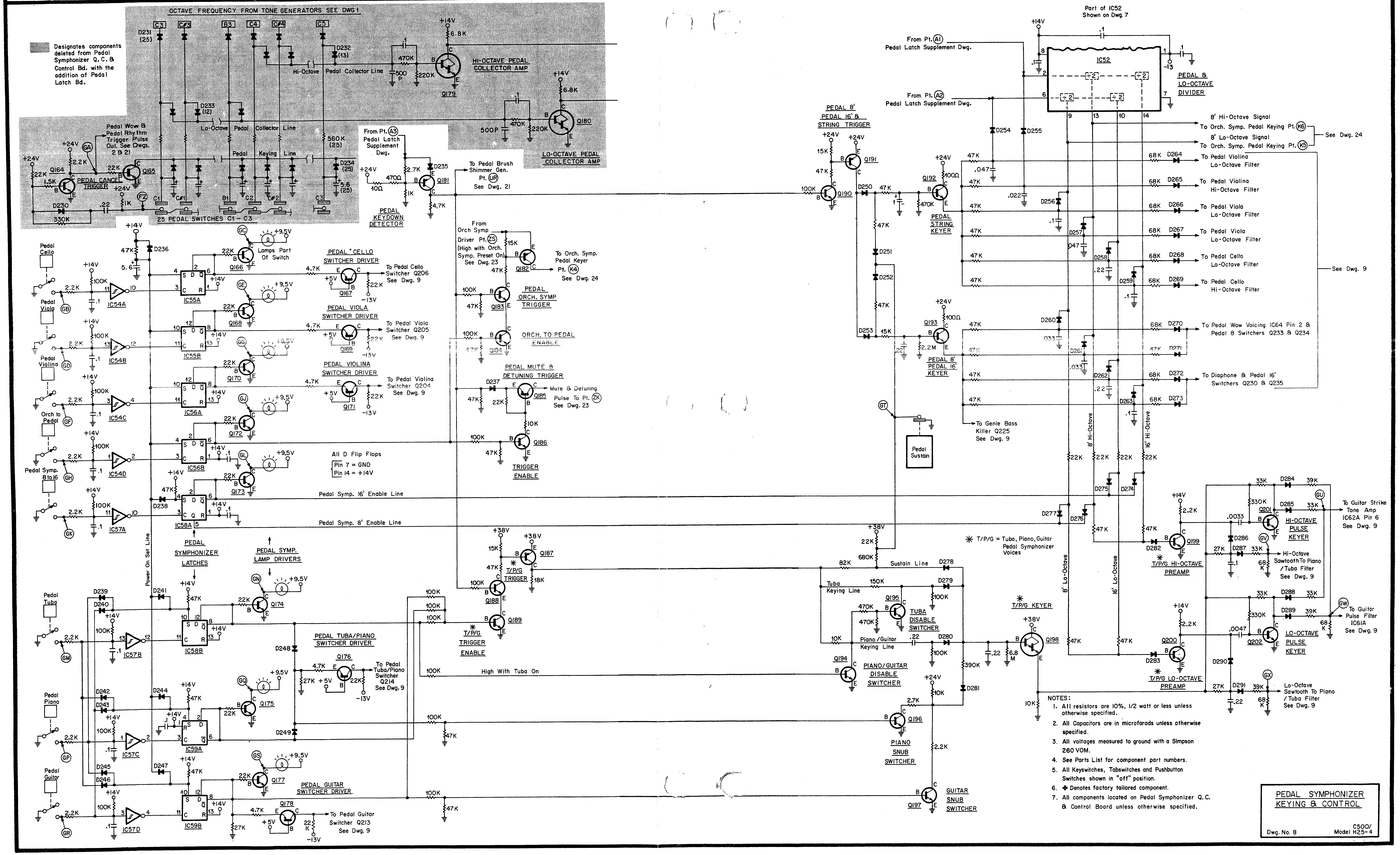
PEDAL LATCH BOARD



From 25 Pedal Switches
+13V
GND
220K
100K
6.8K
M147
IC2
IC3
CD4011
CD4069
IC1
CD4030
C4
Q1
Q2
A1
A2
A3
A4
A5
+13.5V
350uf
C2
10Ω
R2
47Ω
R1
+24V From Voltage Dist. Bd. (Orange wire)
+14V From Voltage Dist. Bd. (Green wire)

SCHEMATIC 8

FOR ORGANS WITH PEDAL LATCH CIRCUIT BOARD


OCTAVE FREQUENCY FROM TONE GENERATORS SEE DWG 1
Designates components deleted from Pedal Symphonizer Q.C. & Control Bd. with the addition of Pedal Latch Bd.
HI-OCTAVE PEDAL COLLECTOR AMP
Q179
Hi-Octave Pedal Collector Line
Lo-Octave Pedal Collector Line
LO-OCTAVE PEDAL COLLECTOR AMP
Q180
Pedal Keying Line
Pedal Wow & Pedal Rhythm Trigger Pulse Out. See Dwgs. 2 & 21
PEDAL CANCEL TRIGGER
Q164
Q165
25 PEDAL SWITCHES C1 - C3
From Pt. A3 Pedal Latch Supplement Dwg.
PEDAL KEYDOWN DETECTOR
Q181
To Pedal Brush Shimmer Gen. Pt. UR See Dwg. 21
Pedal Cello
Pedal Viola
Pedal Violina
Orch to Pedal
Pedal Symp. 8 to 16
IC54A
IC54B
IC54C
IC54D
IC57A
IC55A
IC55B
IC56A
IC56B
IC58A
PEDAL 'CELLO SWITCHER DRIVER
To Pedal Cello Switcher Q206 See Dwg. 9
PEDAL VIOLA SWITCHER DRIVER
To Pedal Viola Switcher Q205 See Dwg. 9
PEDAL VIOLINA SWITCHER DRIVER
To Pedal Violina Switcher Q204 See Dwg. 9
Lamps Part Of Switch
All D Flip Flops
Pin 7 = GND
Pin 14 = +14V
Pedal Symp. 16' Enable Line
Pedal Symp. 8' Enable Line
PEDAL SYMPHONIZER LATCHES
PEDAL SYMP. LAMP DRIVERS
Power On Set Line
From Orch Symp Driver Pt. ZS (High with Orch. Symp. Preset On) See Dwg. 23
To Orch. Symp. Pedal Keyer Pt. K4 See Dwg. 24
Q182
PEDAL ORCH. SYMP TRIGGER
Q183
ORCH. TO PEDAL ENABLE
Q184
PEDAL MUTE & DETUNING TRIGGER
Q185
Mute & Detuning Pulse To Pt. ZK See Dwg. 23
TRIGGER ENABLE
Q186
Pedal Tuba
Pedal Piano
Pedal Guitar
IC57B
IC57C
IC57D
IC58B
IC59A
IC59B
Q174
Q175
Q177
PEDAL TUBA/PIANO SWITCHER DRIVER
Q176
To Pedal Tuba/Piano Switcher Q214 See Dwg. 9
PEDAL GUITAR SWITCHER DRIVER
Q178
To Pedal Guitar Switcher Q213 See Dwg. 9
T/P/G TRIGGER
Q187
Q188
Q189
T/P/G TRIGGER ENABLE
High With Tuba On
Part of IC52 Shown on Dwg. 7
From Pt. A1 Pedal Latch Supplement Dwg.
From Pt. A2 Pedal Latch Supplement Dwg.
IC52
PEDAL 8 LO-OCTAVE DIVIDER
PEDAL 8' PEDAL 16' & STRING TRIGGER
Q190
Q191
Q192
PEDAL STRING KEYER
Q193
PEDAL 8' PEDAL 16' KEYER
8' Hi-Octave Signal To Orch. Symp. Pedal Keying Pt. K6
8' Lo-Octave Signal To Orch. Symp. Pedal Keying Pt. K5
See Dwg. 24
To Pedal Violina Lo-Octave Filter
To Pedal Violina Hi-Octave Filter
To Pedal Viola Lo-Octave Filter
To Pedal Viola Hi-Octave Filter
To Pedal Cello Lo-Octave Filter
To Pedal Cello Hi-Octave Filter
See Dwg. 9
To Pedal Wow Voicing IC64 Pin 2 & Pedal 8 Switchers Q233 & Q234
To Diaphone & Pedal 16' Switchers Q230 & Q235
To Genie Bass Killer Q225 See Dwg. 9
Pedal Sustain
8' Hi-Octave
16' Hi-Octave
8' Lo-Octave
16' Lo-Octave
Sustain Line
Tuba Keying Line
Piano/Guitar Keying Line
Q195
TUBA DISABLE SWITCHER
Q194
PIANO/GUITAR DISABLE SWITCHER
Q196
PIANO SNUB SWITCHER
Q197
GUITAR SNUB SWITCHER
T/P/G = Tuba, Piano, Guitar Pedal Symphonizer Voices
T/P/G KEYER
Q198
Q199
T/P/G HI-OCTAVE PREAMP
Q200
T/P/G LO-OCTAVE PREAMP
Q201
HI-OCTAVE PULSE KEYER
Q202
LO-OCTAVE PULSE KEYER
To Guitar Strike Tone Amp IC62A Pin 6 See Dwg. 9
Hi-Octave Sawtooth To Piano / Tuba Filter See Dwg. 9
To Guitar Pulse Filter IC61A See Dwg. 9
Lo-Octave Sawtooth To Piano / Tuba Filter See Dwg. 9

NOTES:
1. All resistors are 10%, 1/2 watt or less unless otherwise specified.
2. All Capacitors are in microfarads unless otherwise specified.
3. All voltages measured to ground with a Simpson 260 VOM.
4. See Parts List for component part numbers.
5. All Keyswitches, Tabswitches and Pushbutton Switches shown in "off" position.
6. ✱ Denotes factory tailored component.
7. All components located on Pedal Symphonizer Q.C. & Control Board unless otherwise specified.

PEDAL SYMPHONIZER
KEYING & CONTROL

Dwg. No. 8
C500/
Model H25-4